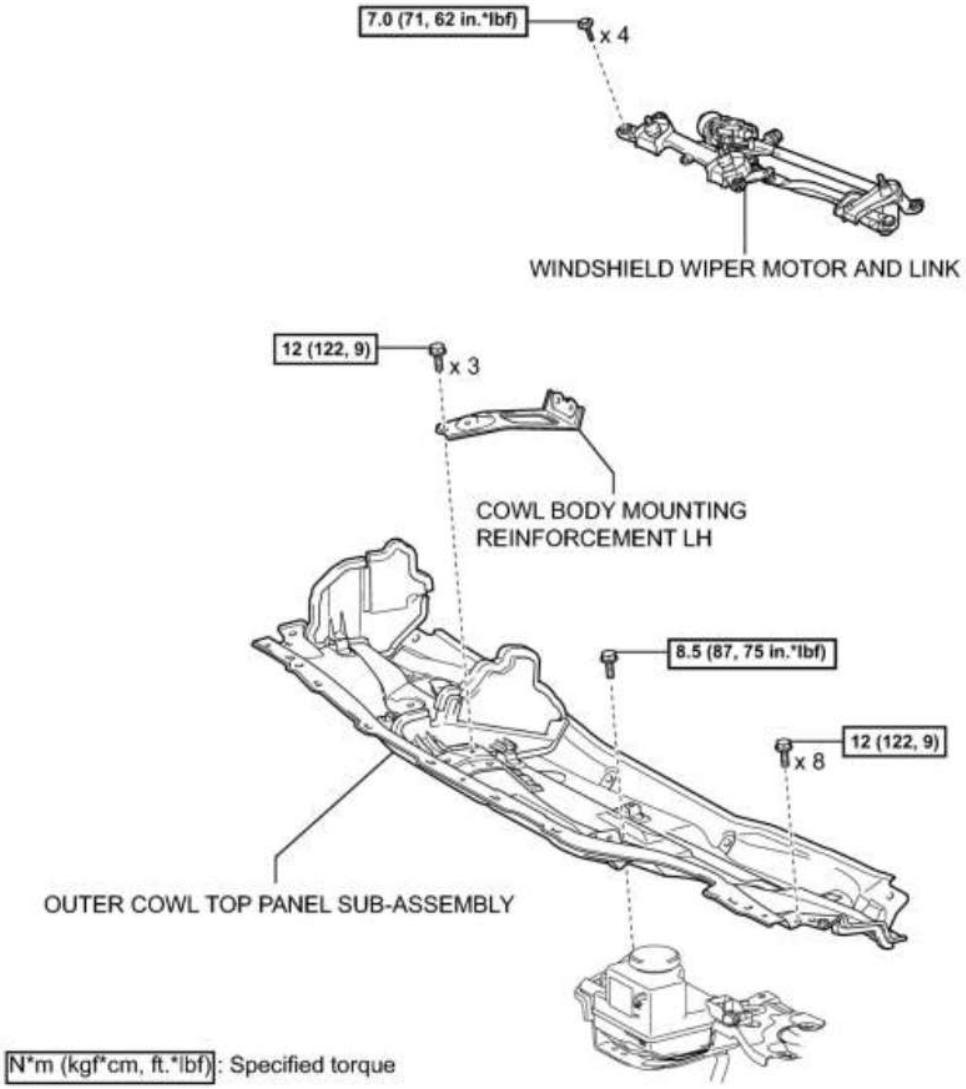
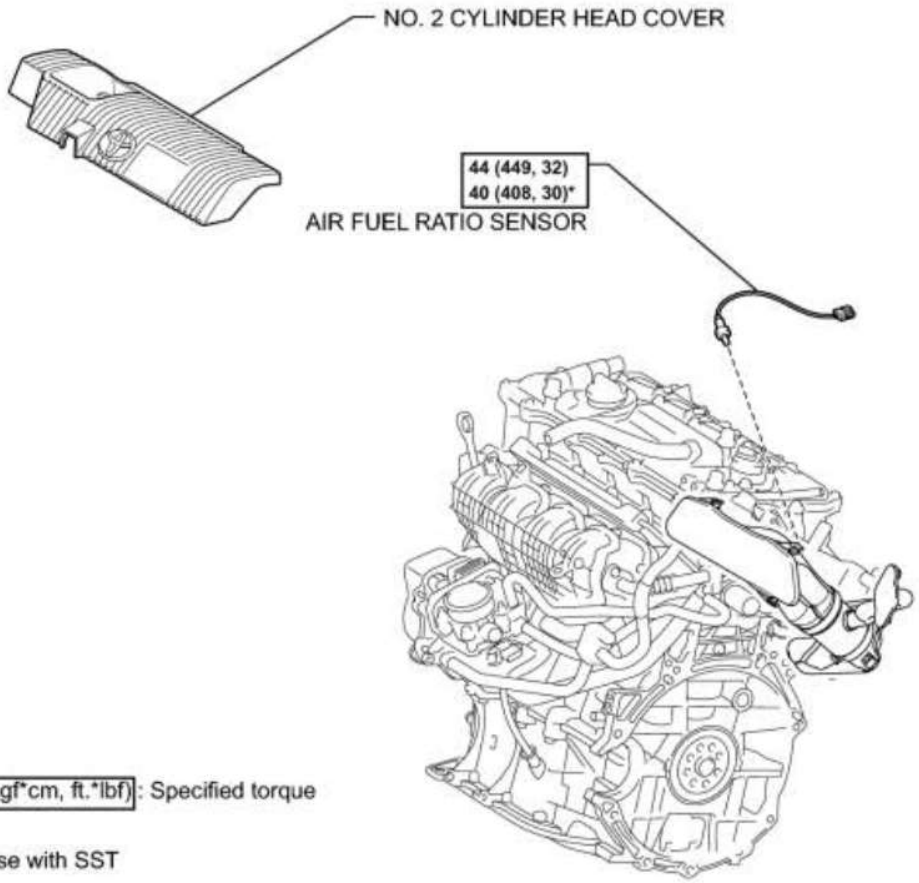
COMPONENTS

ILLUSTRATION



ILLUSTRATION

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N*m (kgf*cm, ft.*lbf): Specified torque

* For use with SST

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REMOVAL

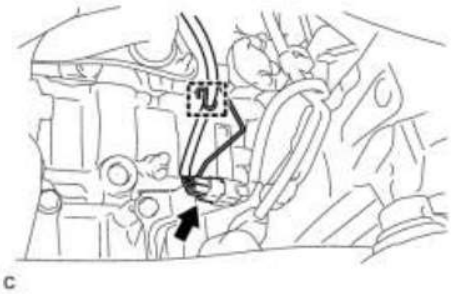
1. REMOVE WINDSHIELD WIPER MOTOR AND LINK

(a) Remove the windshield wiper motor and link INFO.

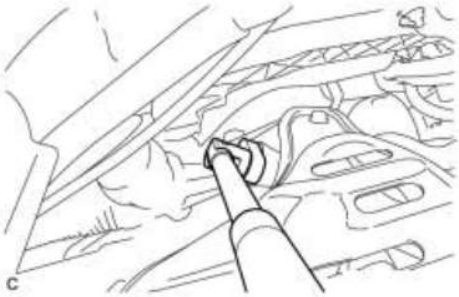
2. REMOVE OUTER COWL TOP PANEL SUB-ASSEMBLY INFO

3. REMOVE NO. 2 CYLINDER HEAD COVER INFO

4. REMOVE AIR FUEL RATIO SENSOR



(a) Disconnect the air fuel ratio sensor connector and clamp.



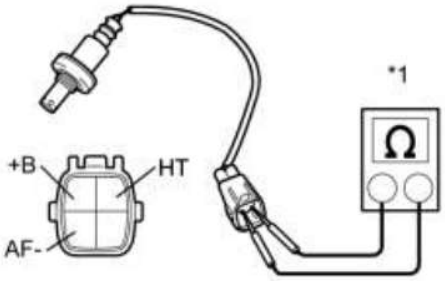
(b) Using SST, remove the air fuel ratio sensor.

SST: 09224-00010

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INSPECTION

1. INSPECT AIR FUEL RATIO SENSOR



Text in Illustration

*1	Ohmmeter

(a) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

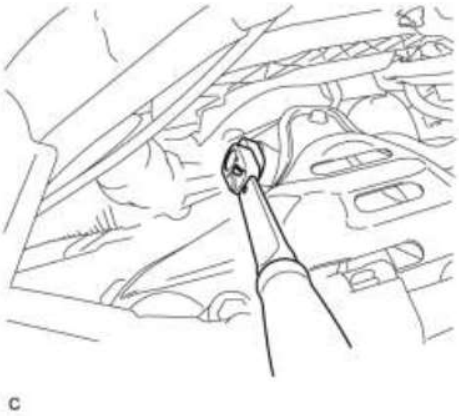
Tester Connection	Condition	Specified Condition
(HT) - (+B)	20°C (68°F)	1.8 to 3.4 Ω
(HT) - (AF-)	-	10 kΩ or higher

If the result is not as specified, replace the air fuel ratio sensor.

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INSTALLATION

1. INSTALL AIR FUEL RATIO SENSOR



C

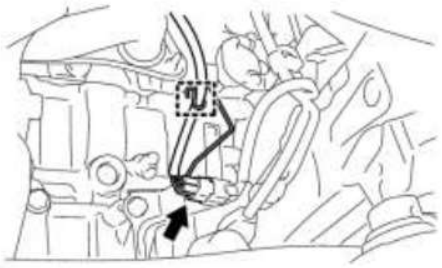
(a) Using SST, install the air fuel ratio sensor.

SST: 09224-00010

without SST - Torque: **44 N·m (449 kgf·cm, 32ft·lbf)**

with SST - Torque: **40 N·m (408 kgf·cm, 30ft·lbf)**

- The "with SST" torque value is effective when using SST with a fulcrum length of 30 mm (1.18 in.).
- The "with SST" torque value is effective when using a torque wrench with a fulcrum length of 300 mm (11.81 in.) INFO.
- This torque value is effective when SST is parallel to the torque wrench.



C

(b) Connect the air fuel ratio sensor connector and clamp.

2. INSTALL NO. 2 CYLINDER HEAD COVER INFO

3. INSPECT FOR EXHAUST GAS LEAK

4. INSTALL OUTER COWL TOP PANEL SUB-ASSEMBLY INFO

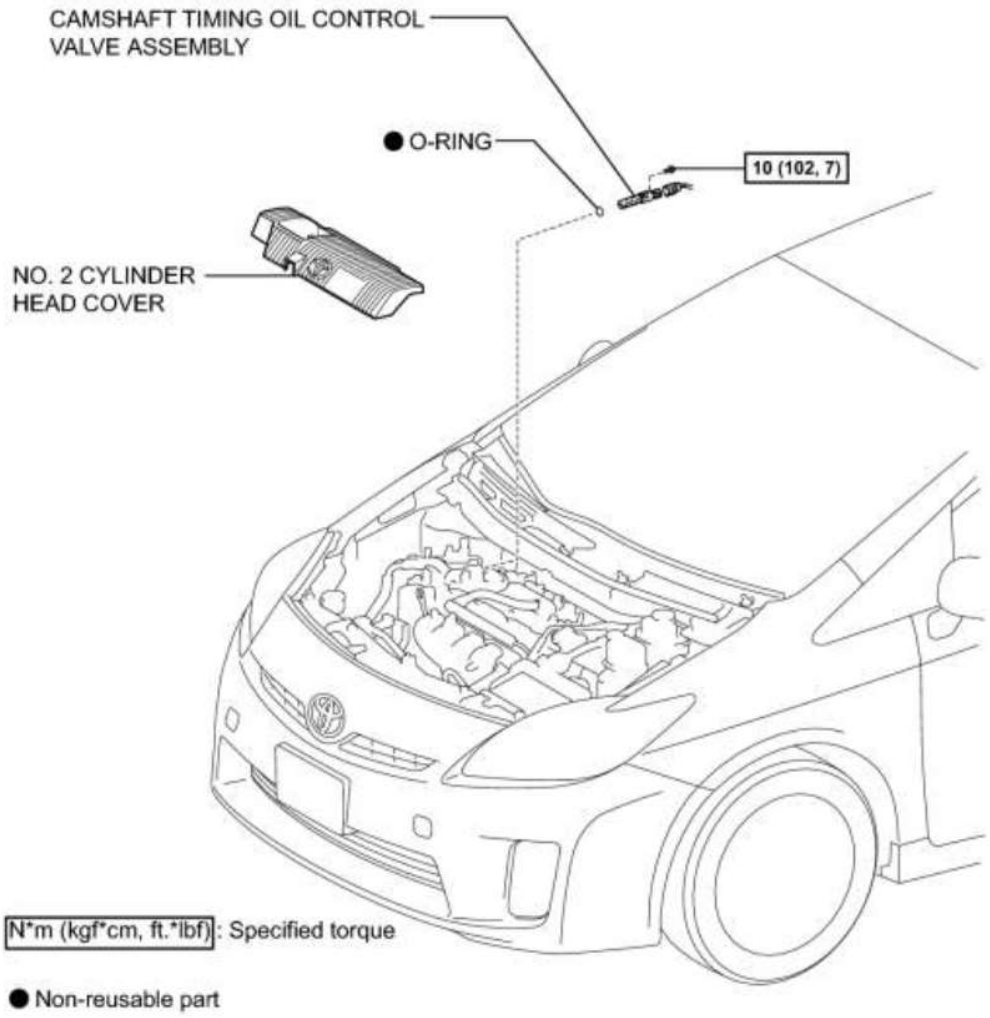
5. INSTALL WINDSHIELD WIPER MOTOR AND LINK

(a) Install the windshield wiper motor and link INFO.

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COMPONENTS

ILLUSTRATION



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ON-VEHICLE INSPECTION

1. INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

(a) Connect the Techstream to the DLC3.

(b) Turn the Techstream on.

(c) Set the vehicle to the inspection mode INFO.

(d) Start the engine.

(e) Inspect the oil control valve.

(1) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the VVT System (Bank 1).

(2) Check the engine speed when the oil control valve is operated using the Techstream with the engine coolant temperature at 50°C (122°F) or less.

HINT:

- When performing the Active Test, the air conditioning should be on.
- Engine coolant temperature when the engine is started should be 30°C (86°F) or less.

Standard:

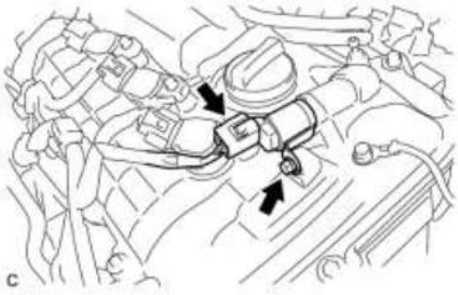
Control Range	Specified Condition
OFF	Normal engine speed
ON	Rough idle or engine stalls (soon after oil control valve switched from OFF to ON)

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REMOVAL

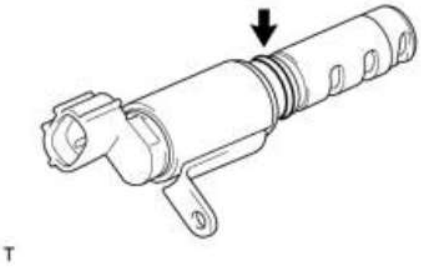
1. REMOVE NO. 2 CYLINDER HEAD COVER INFO

2. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY



(a) Disconnect the camshaft timing oil control valve assembly connector.

(b) Remove the bolt and remove the camshaft timing oil control valve assembly.

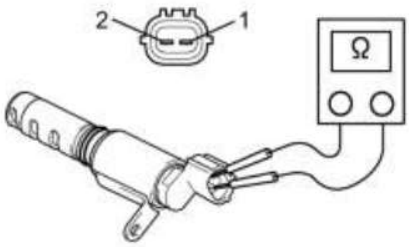


(c) Remove the O-ring from the camshaft timing oil control valve assembly.

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INSPECTION

1. INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY



(a) Measure the resistance according to the value(s) in the table below.

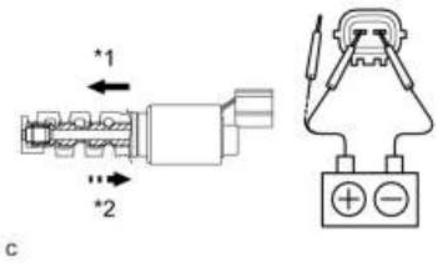
Standard Resistance:

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	6.9 to 7.9 Ω

If the result is not as specified, replace the oil control valve assembly.

(b) Check the operation.

(1) Connect a positive (+) battery lead to terminal 1 and a negative (-) lead to terminal 2, and check the movement of the valve.



Text in Illustration

*1	When Applied
*2	When Cut Off

NOTICE:

Confirm that the valve moves freely and does not stick in any position.

If necessary, replace the camshaft timing oil control valve assembly.

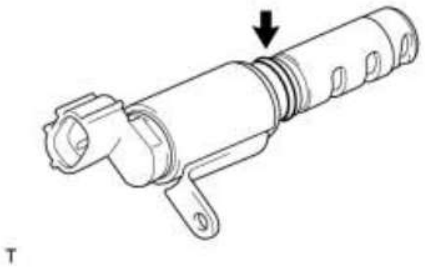
HINT:

Accumulation of foreign matter can cause minor pressure leaks. Minor pressure leaks will cause the camshaft to advance or retard, and this will cause a DTC to be set.

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INSTALLATION

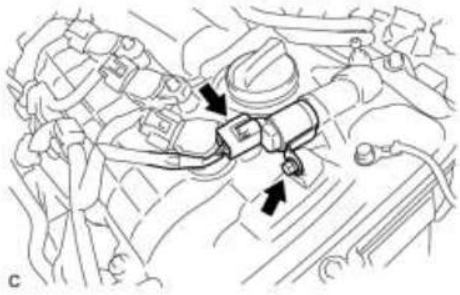
1. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY



(a) Apply a light coat of engine oil to a new O-ring and install it onto the camshaft timing oil control valve assembly.

NOTICE:

Do not twist the O-ring.



(b) Install the camshaft timing oil control valve assembly and wire harness bracket with the bolt.

Torque: **10 N·m (102 kgf·cm, 7ft·lbf)**

(c) Connect the camshaft timing oil control valve assembly connector.

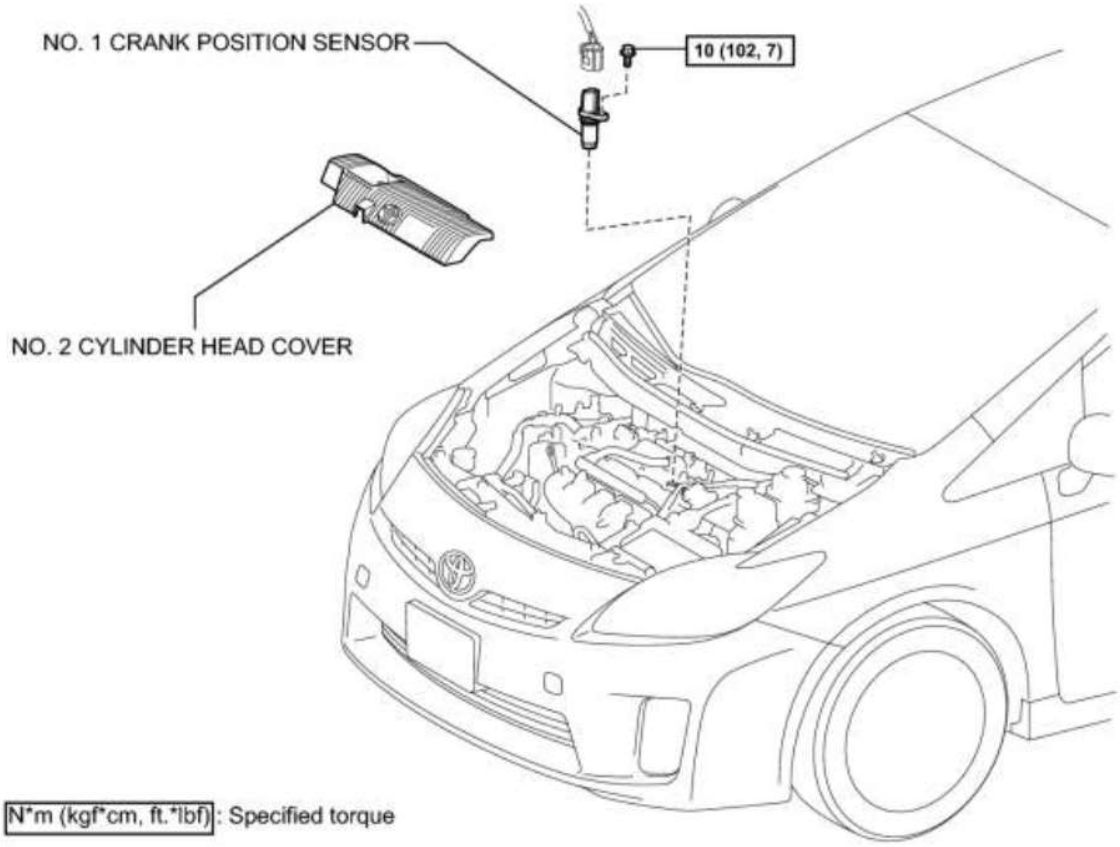
2. INSPECT FOR OIL LEAK

3. INSTALL NO. 2 CYLINDER HEAD COVER INFO

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COMPONENTS

ILLUSTRATION



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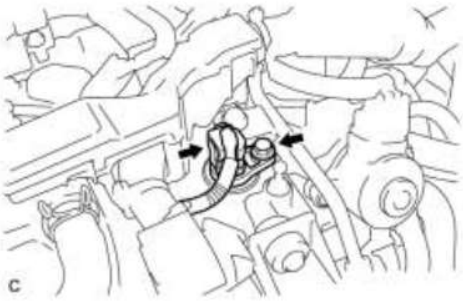
REMOVAL

HINT:

Although the part name refers to the No. 1 crank position sensors, this procedure is for the camshaft position sensors.

1. REMOVE NO. 2 CYLINDER HEAD COVER INFO

2. REMOVE NO. 1 CRANK POSITION SENSOR



(a) Disconnect the No. 1 crank position sensor connector.

(b) Remove the bolt and No. 1 crank position sensor.

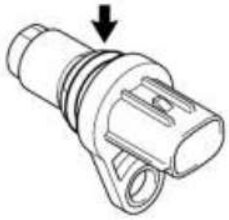
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INSTALLATION

HINT:

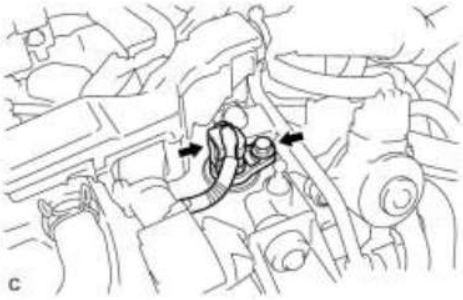
Although the part name refers to the No. 1 crank position sensors, this procedure is for the camshaft position sensors.

1. INSTALL NO. 1 CRANK POSITION SENSOR



T

(a) Apply a light coat of engine oil to the O-rings on the No. 1 crank position sensors.



C

(b) Install the No. 1 crank position sensor with the bolt.

Torque: **10 N·m (102 kgf·cm, 7ft·lbf)**

(c) Connect the No. 1 crank position sensor connector.

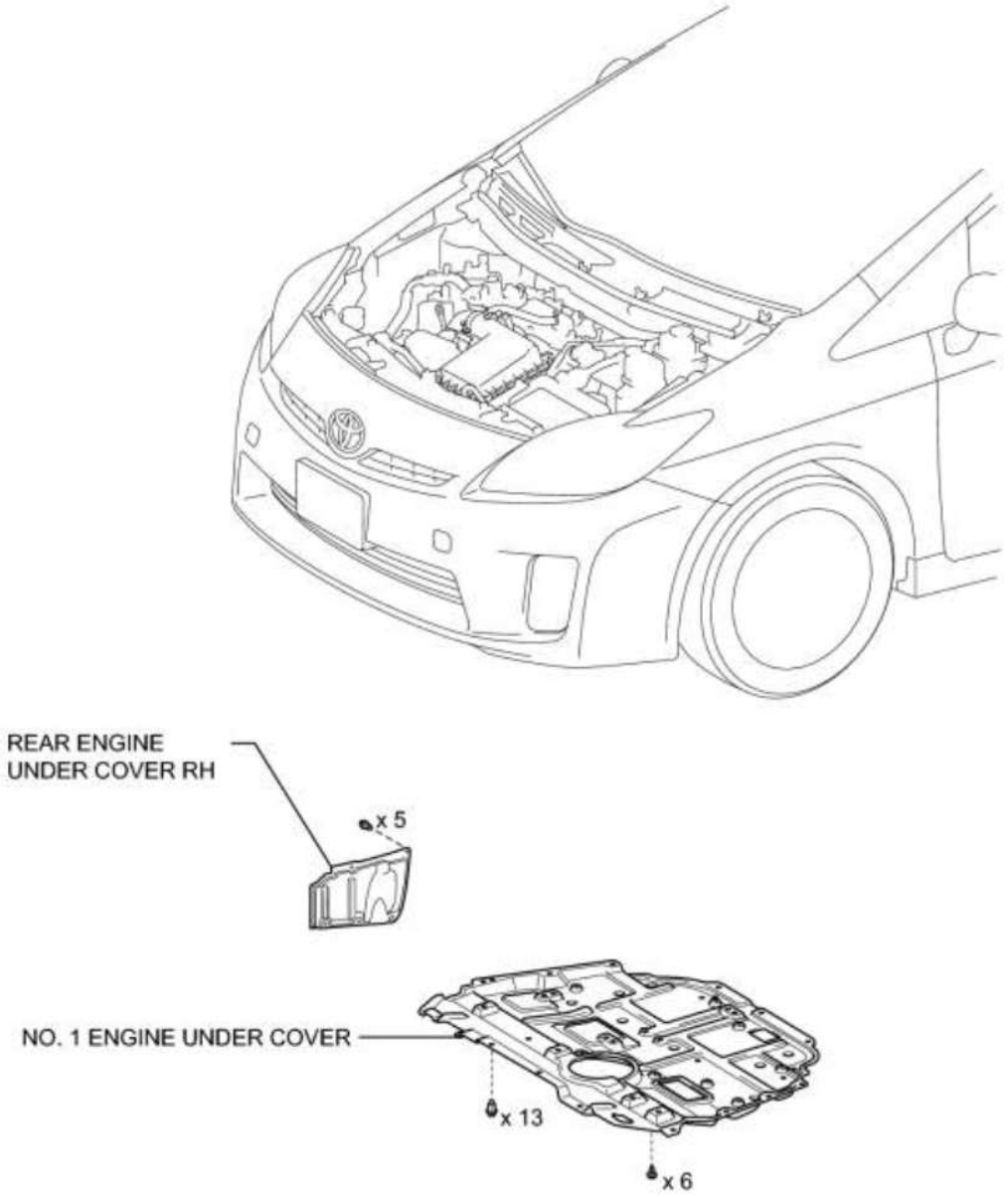
2. INSPECT FOR OIL LEAK

3. INSTALL NO. 2 CYLINDER HEAD COVER INFO

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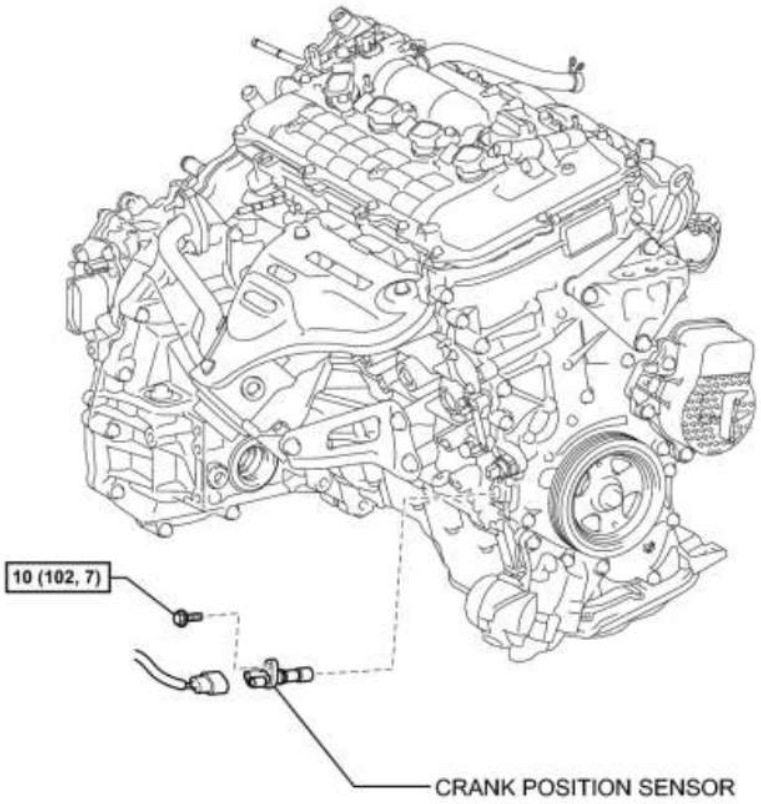
COMPONENTS

ILLUSTRATION



ILLUSTRATION

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N*m (kgf*cm, ft.*lbf): Specified torque

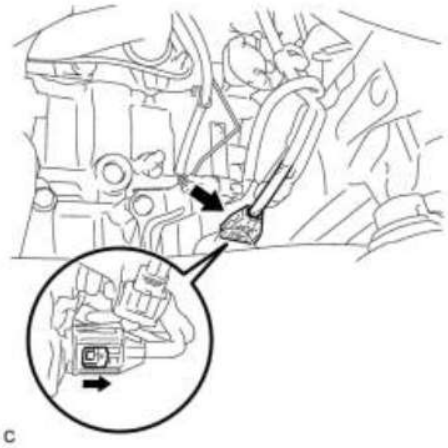
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REMOVAL

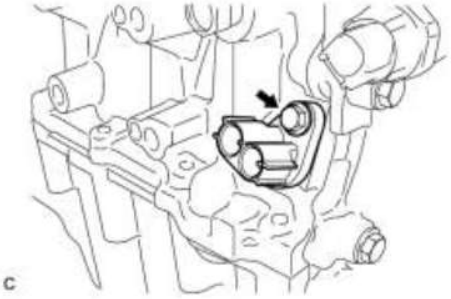
1. REMOVE REAR ENGINE UNDER COVER RH

2. REMOVE NO. 1 ENGINE UNDER COVER

3. REMOVE CRANK POSITION SENSOR



(a) Disconnect the crank position sensor connector.



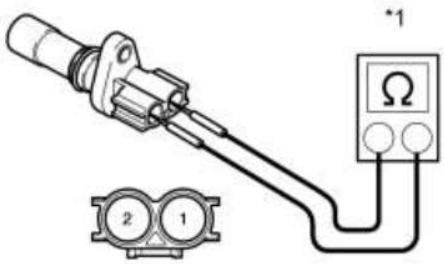
(b) Remove the bolt and crank position sensor.

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INSPECTION

1. INSPECT CRANK POSITION SENSOR

(a) Measure the resistance according to the value(s) in the table below.



Text in Illustration

*1	Ohmmeter

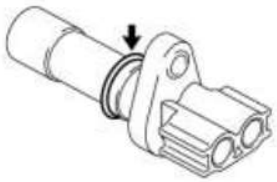
Standard Resistance:

Tester Connection	Condition	Specified Condition
1 - 2	-10 to 50°C (14 to 122°F)	1850 to 2450 Ω

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INSTALLATION

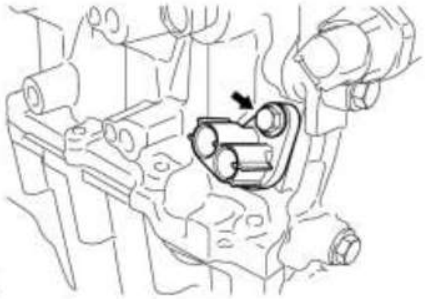
1. INSTALL CRANK POSITION SENSOR



B

(a) Apply a light coat of engine oil to the O-ring on the crank position sensor.

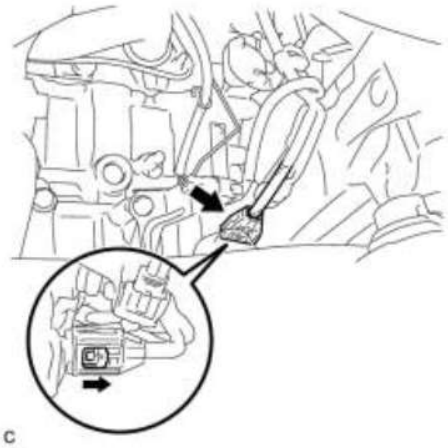
(b) Install the crank position sensor with the bolt.



C

Torque: **10 N·m (102 kgf·cm, 7ft·lbf)**

Connect the crank position sensor connector.



C

2. INSPECT FOR OIL LEAK

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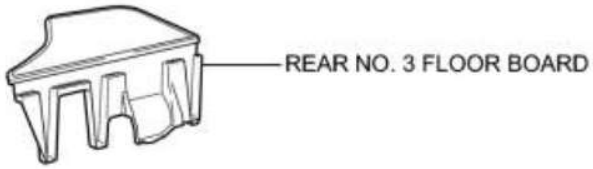
3. INSTALL NO. 1 ENGINE UNDER COVER

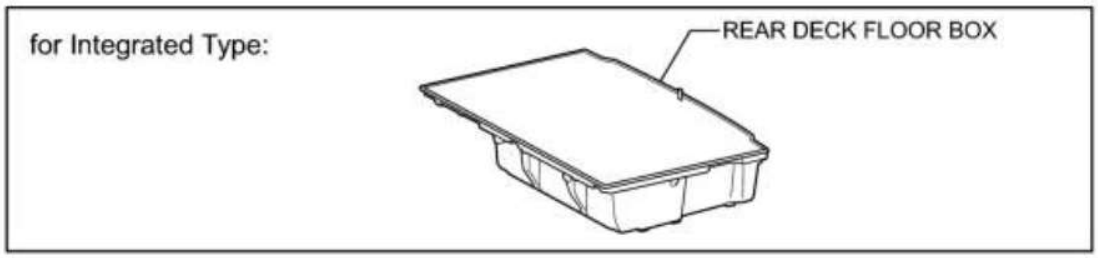
4. INSTALL REAR ENGINE UNDER COVER RH

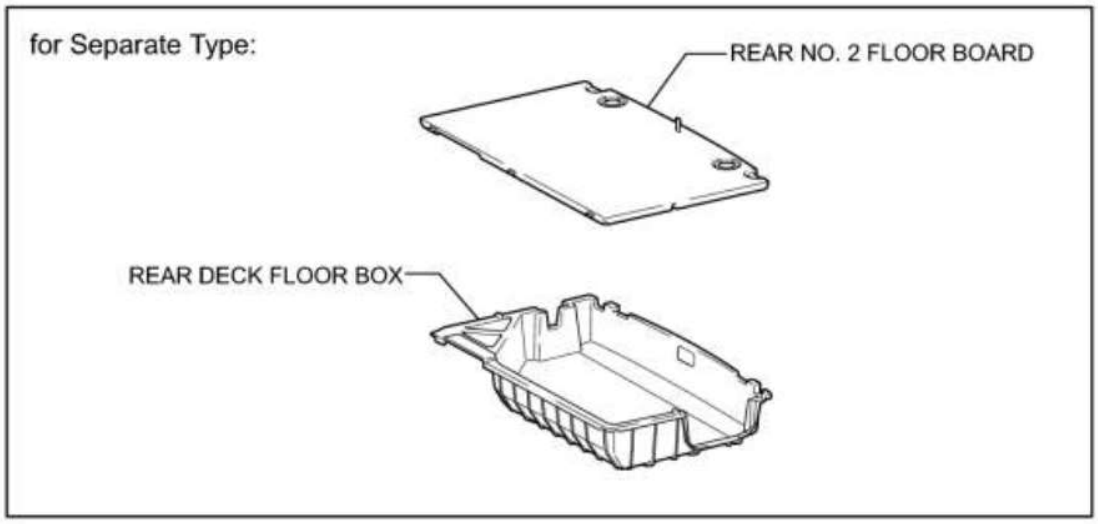
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COMPONENTS

ILLUSTRATION



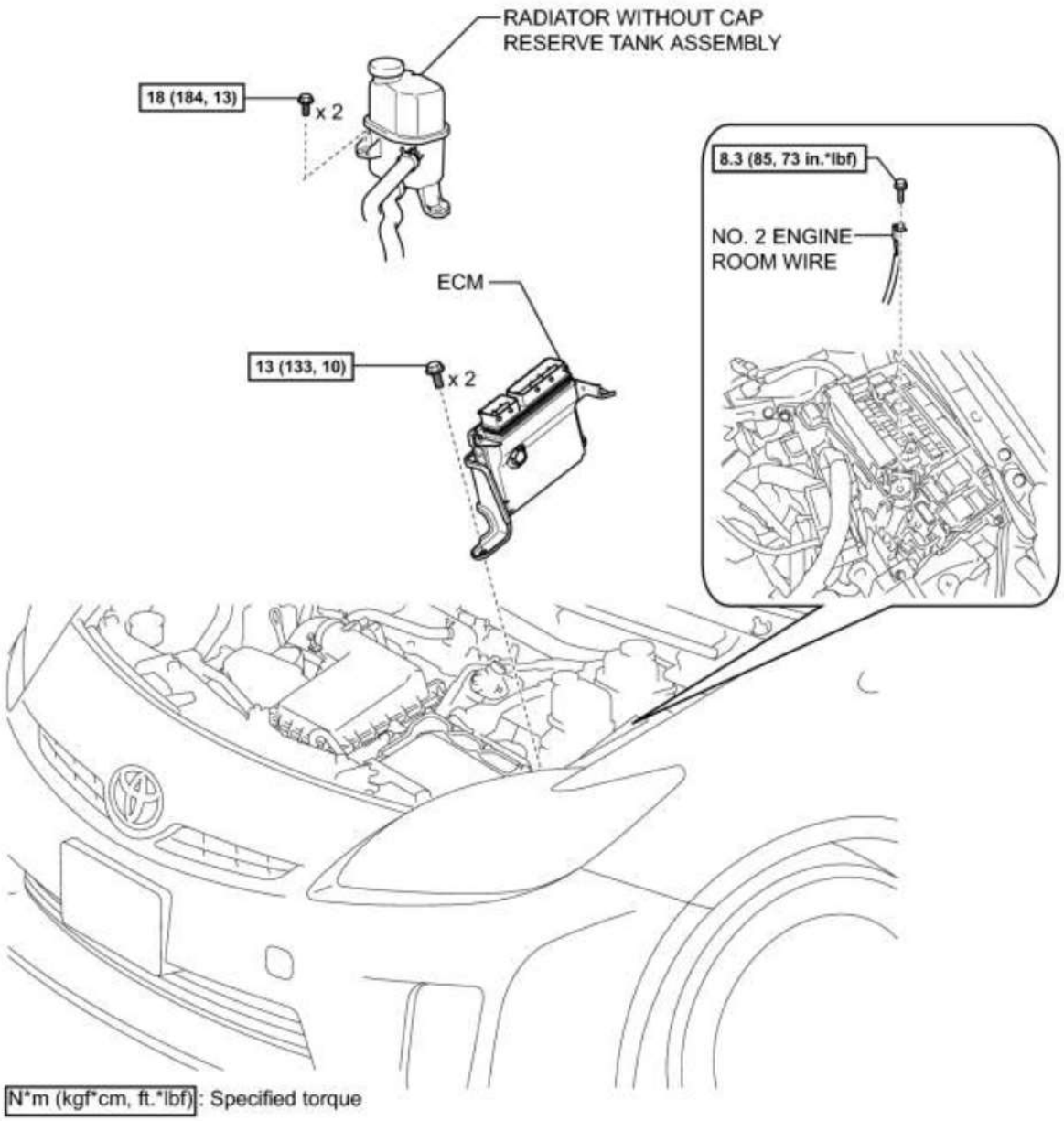




P

ILLUSTRATION

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REMOVAL

1. REMOVE REAR NO. 2 FLOOR BOARD (for Separate Type) INFO

2. REMOVE REAR DECK FLOOR BOX INFO

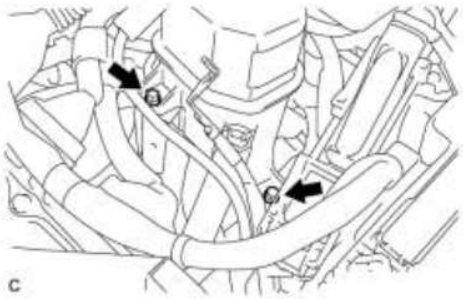
3. REMOVE REAR NO. 3 FLOOR BOARD INFO

4. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

NOTICE:

When disconnecting the cable, some systems need to be initialized after the cable is reconnected INFO.

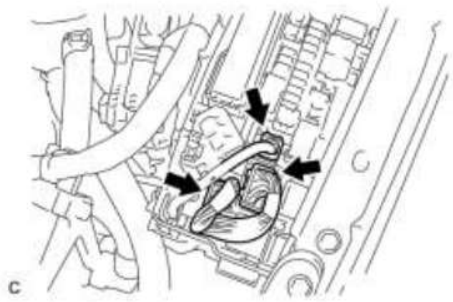
5. SEPARATE RADIATOR WITHOUT CAP RESERVE TANK ASSEMBLY



(a) Remove the 2 bolts and separate the radiator without cap reserve tank assembly.

6. REMOVE ECM

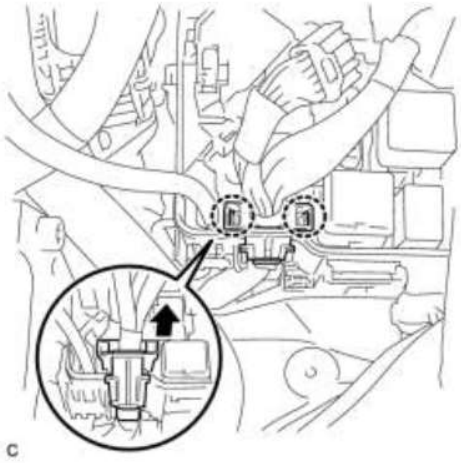
(a) Remove the No. 1 relay block cover.

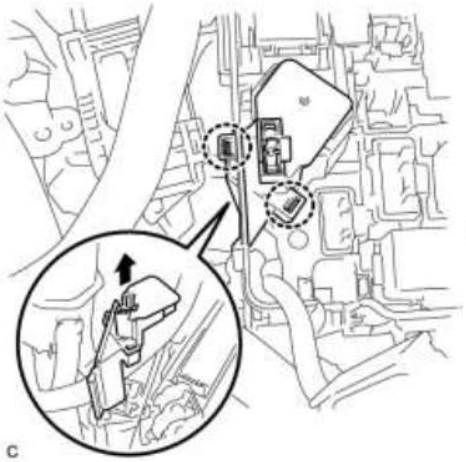


(b) Disconnect the 3 wire harness connectors.

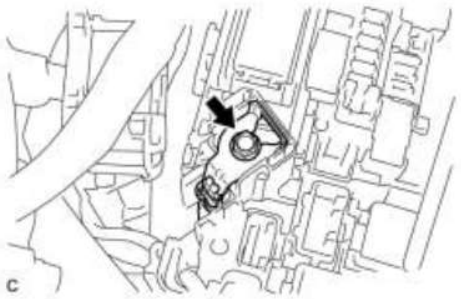
(c) Disengage the 2 claws, push up the engine room wire harness and separate it from the engine room relay block.

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(d) Disengage the 2 claws and push up the side cover to remove it.

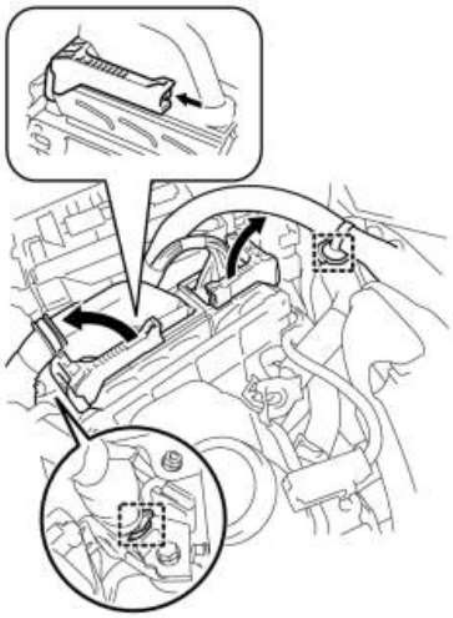


(e) Loosen the bolt and separate the No. 2 engine room wire.

(f) Disconnect the 2 ECM connectors.

(1) Disconnect the 2 wire harness clamps.

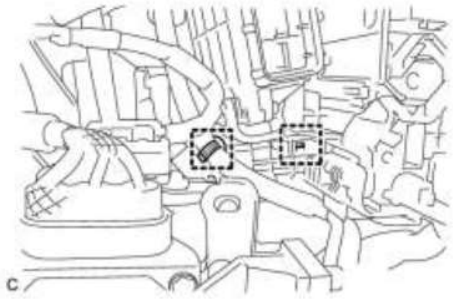
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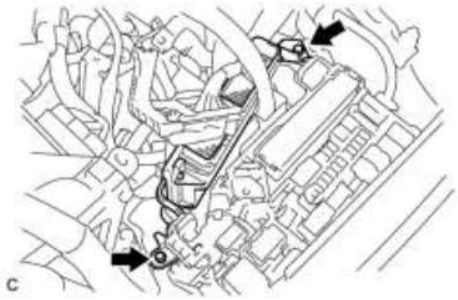
(2) Push the locks on the 2 levers, then raise the levers, and disconnect the 2 ECM connectors.

NOTICE:

After disconnecting the connectors, make sure that dirt, water or other foreign matter does not contact the connecting parts of the connectors.



(g) Separate the 2 wire harness clamps.

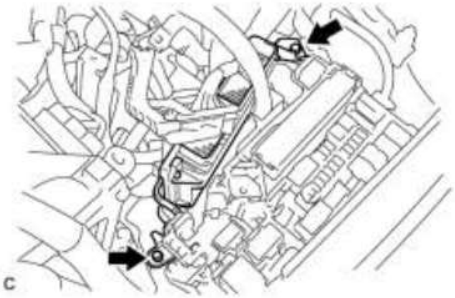


(h) Remove the 2 bolts and ECM with 2 ECM brackets.

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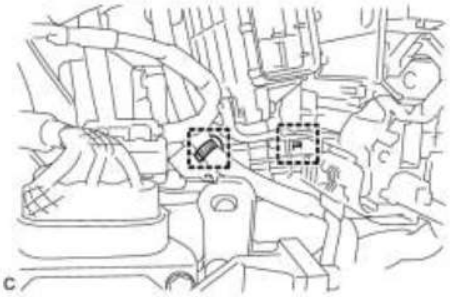
INSTALLATION

1. INSTALL ECM



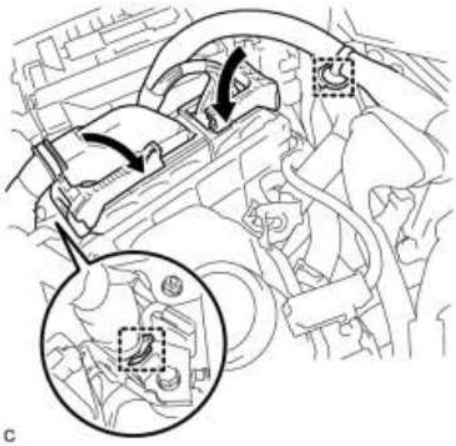
(a) Install the ECM with the 2 bolts.

Torque: **13 N·m (133 kgf·cm, 10ft·lbf)**



(b) Install the 2 wire harness clamps.

(c) Connect the 2 ECM connectors.



(1) Connect the 2 ECM connectors and lower the 2 levers.

- When connecting the connectors, make sure that dirt, water or other foreign matter does not get caught between the connectors and other parts.
- Make sure that the 2 levers are securely locked.

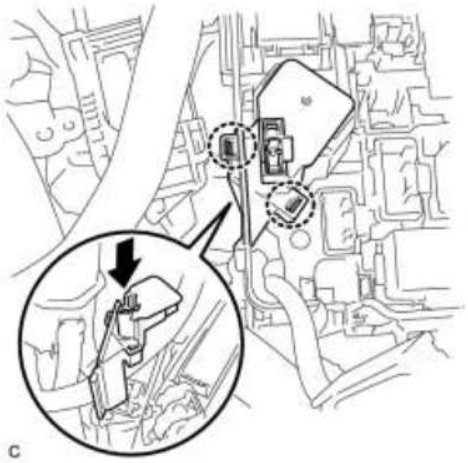
(2) Install the 2 wire harness clamps.

(d) Install the No. 2 engine room wire with the bolt.

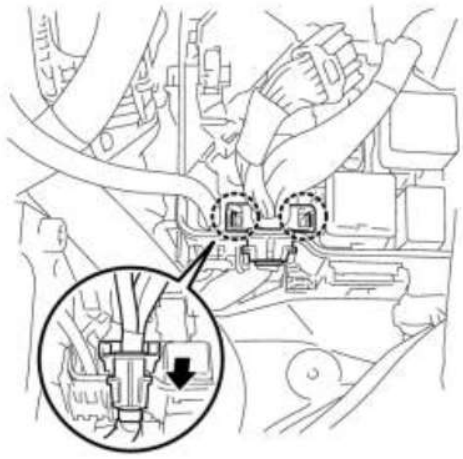
Torque: **8.3 N·m (85 kgf·cm, 73in·lbf)**

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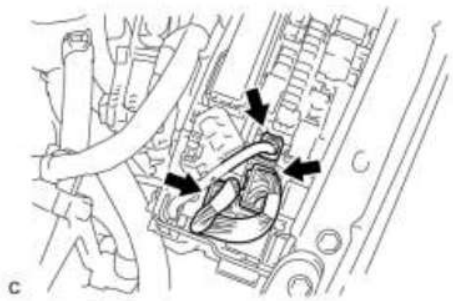




(e) Slide the side cover down and engage the 2 claws to install it.



(f) Slide the engine room wire harness down and engage the 2 claws to install it.

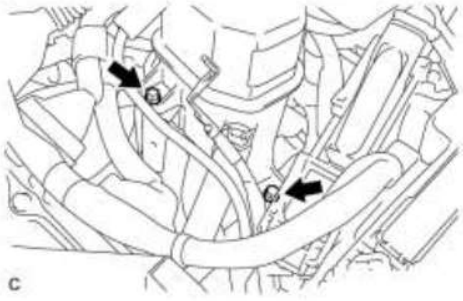


(g) Connect the 3 wire harness connectors.

(h) Install the No. 1 relay block cover.

2. INSTALL RADIATOR WITHOUT CAP RESERVE TANK ASSEMBLY

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(a) Install the radiator without cap reserve tank assembly with the 2 bolts.

Torque: **18 N·m (184 kgf·cm, 13ft·lbf)**

3. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

NOTICE:

When disconnecting the cable, some systems need to be initialized after the cable is reconnected INFO.

4. INSTALL REAR NO. 3 FLOOR BOARD INFO

5. INSTALL REAR DECK FLOOR BOX INFO

6. INSTALL REAR NO. 2 FLOOR BOARD (for Separate Type) INFO

7. PERFORM INITIALIZATION

HINT:

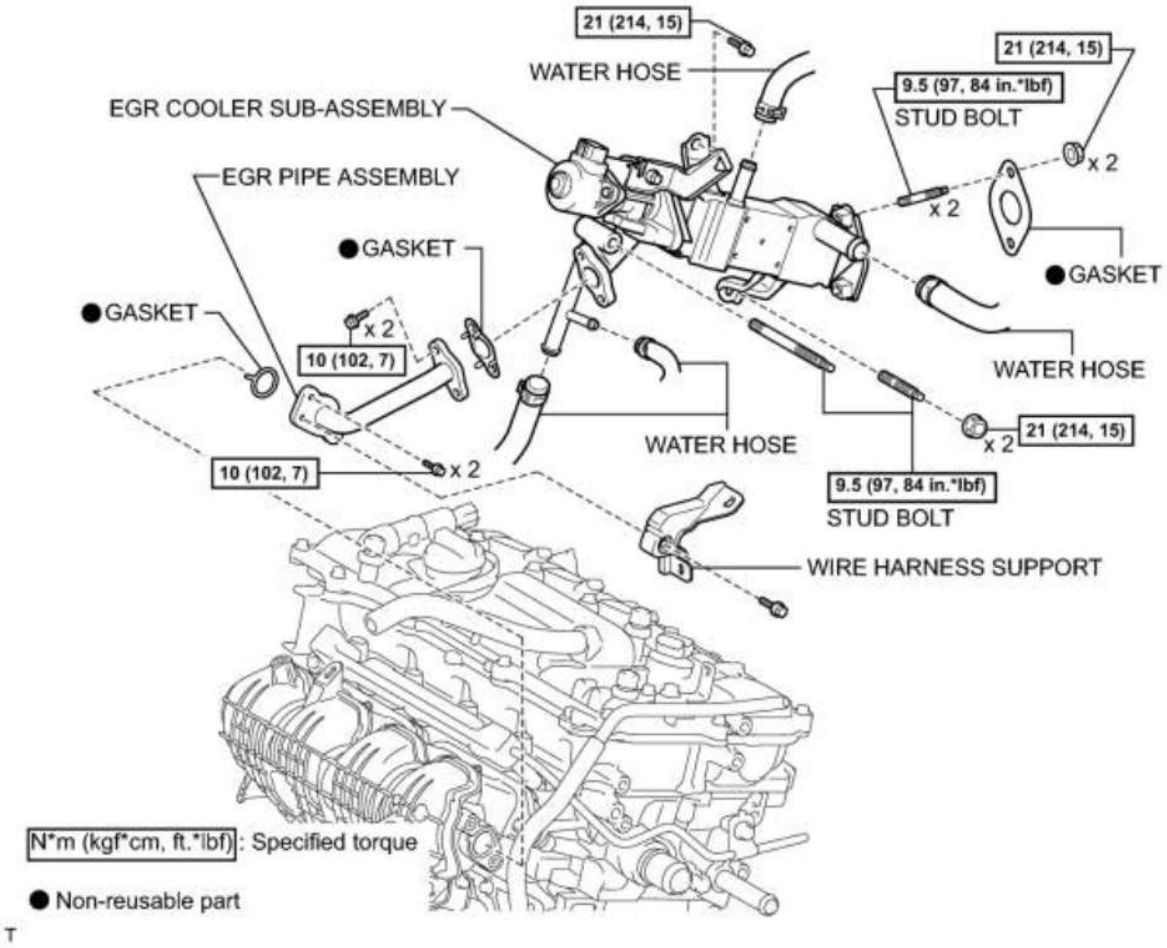
Initialization cannot be completed by only disconnecting and reconnecting the cable of the negative (-) battery terminal.

(a) Perform Initialization when replacing the ECM INFO.

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COMPONENTS

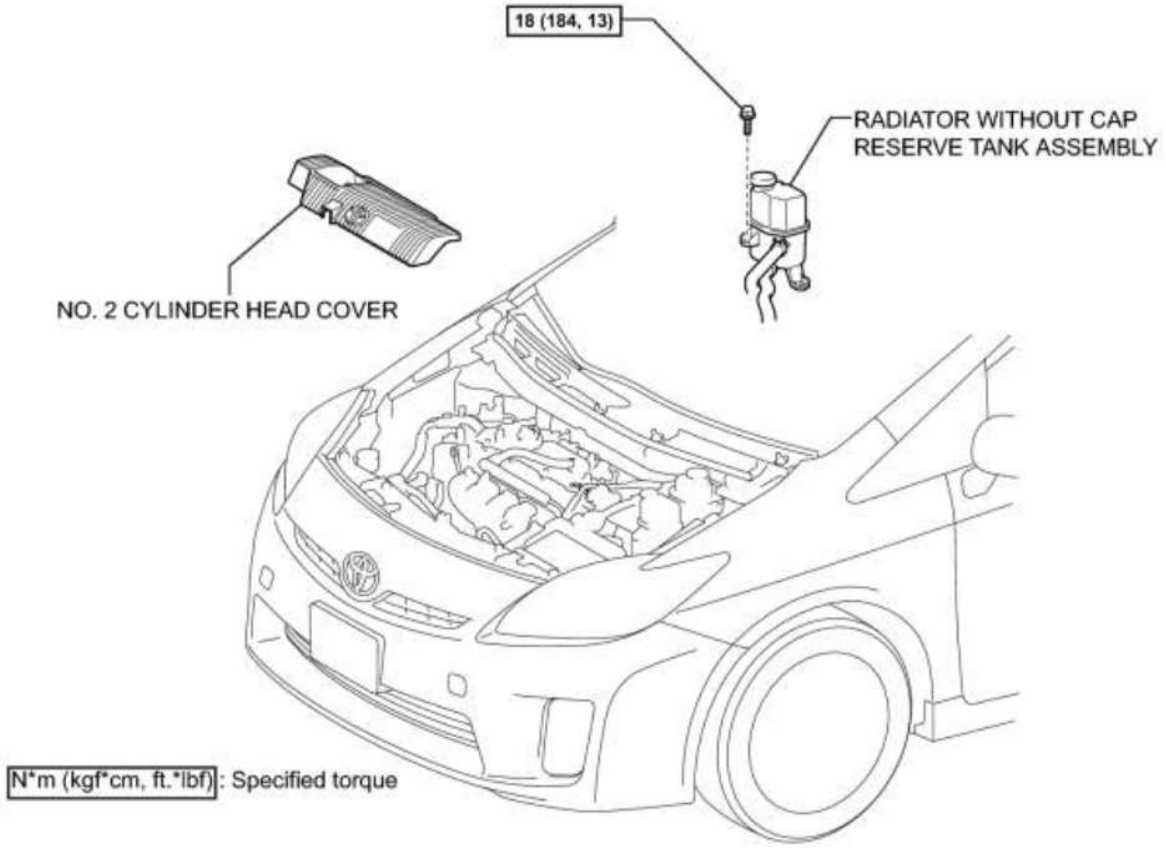
ILLUSTRATION



T

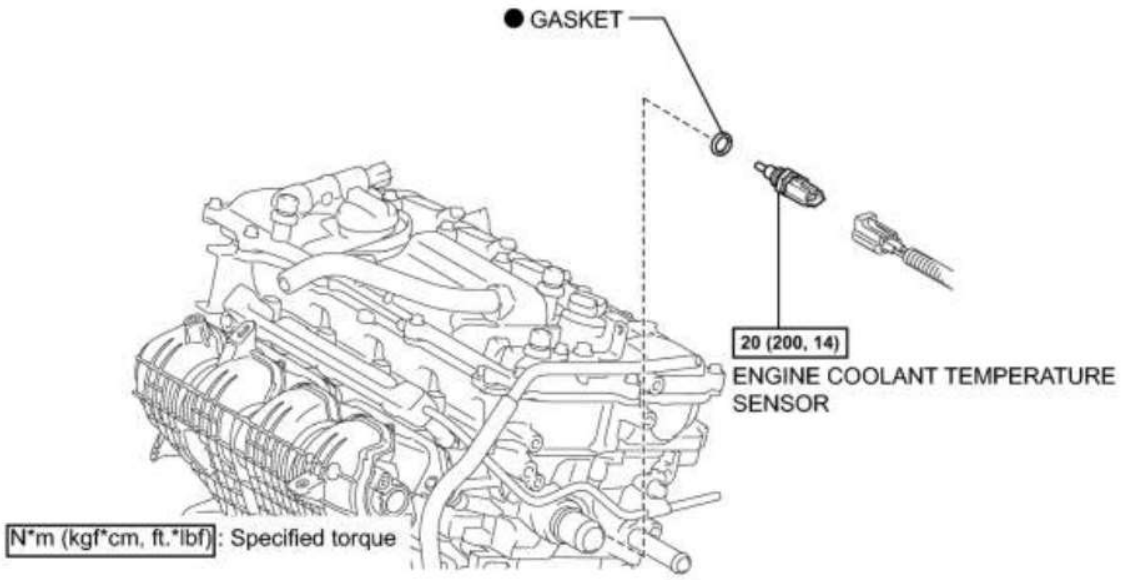
ILLUSTRATION

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ILLUSTRATION

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REMOVAL

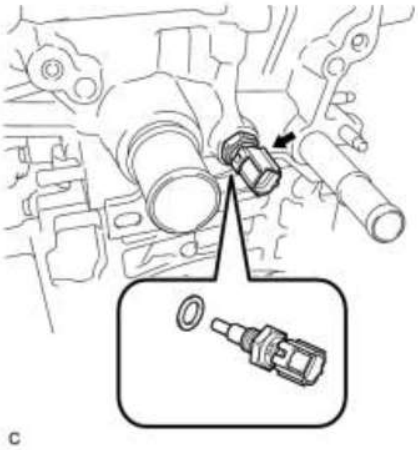
1. REMOVE EGR WITH COOLER PIPE SUB-ASSEMBLY

(a) Remove the EGR with cooler pipe sub-assembly INFO.

2. REMOVE RADIATOR WITHOUT CAP RESERVE TANK ASSEMBLY INFO

3. REMOVE ENGINE COOLANT TEMPERATURE SENSOR

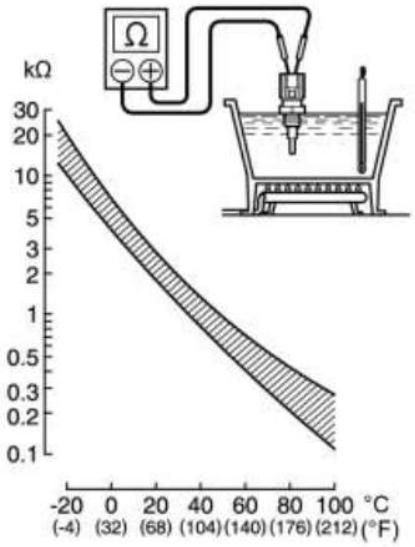
(a) Disconnect the engine coolant temperature sensor connector.



(b) Remove the engine coolant temperature sensor.

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INSPECTION



1. INSPECT ENGINE COOLANT TEMPERATURE SENSOR

(a) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Condition	Specified Condition
Approximately 20°C (68°F)	2.32 to 2.59 kΩ
Approximately 80°C (176°F)	0.310 to 0.326 kΩ

NOTICE:

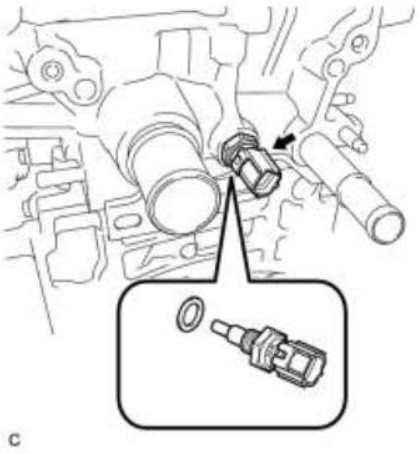
When checking the engine coolant temperature sensor in water, keep the terminals dry. After the check, dry the sensor.

If the resistance is not as specified, replace the engine coolant temperature sensor.

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INSTALLATION

1. INSTALL ENGINE COOLANT TEMPERATURE SENSOR



(a) Install the engine coolant temperature sensor through a new gasket.

Torque: **20 N·m (200 kgf·cm, 14ft·lbf)**

(b) Connect the engine coolant temperature sensor connector.

2. INSTALL RADIATOR WITHOUT CAP RESERVE TANK ASSEMBLY INFO

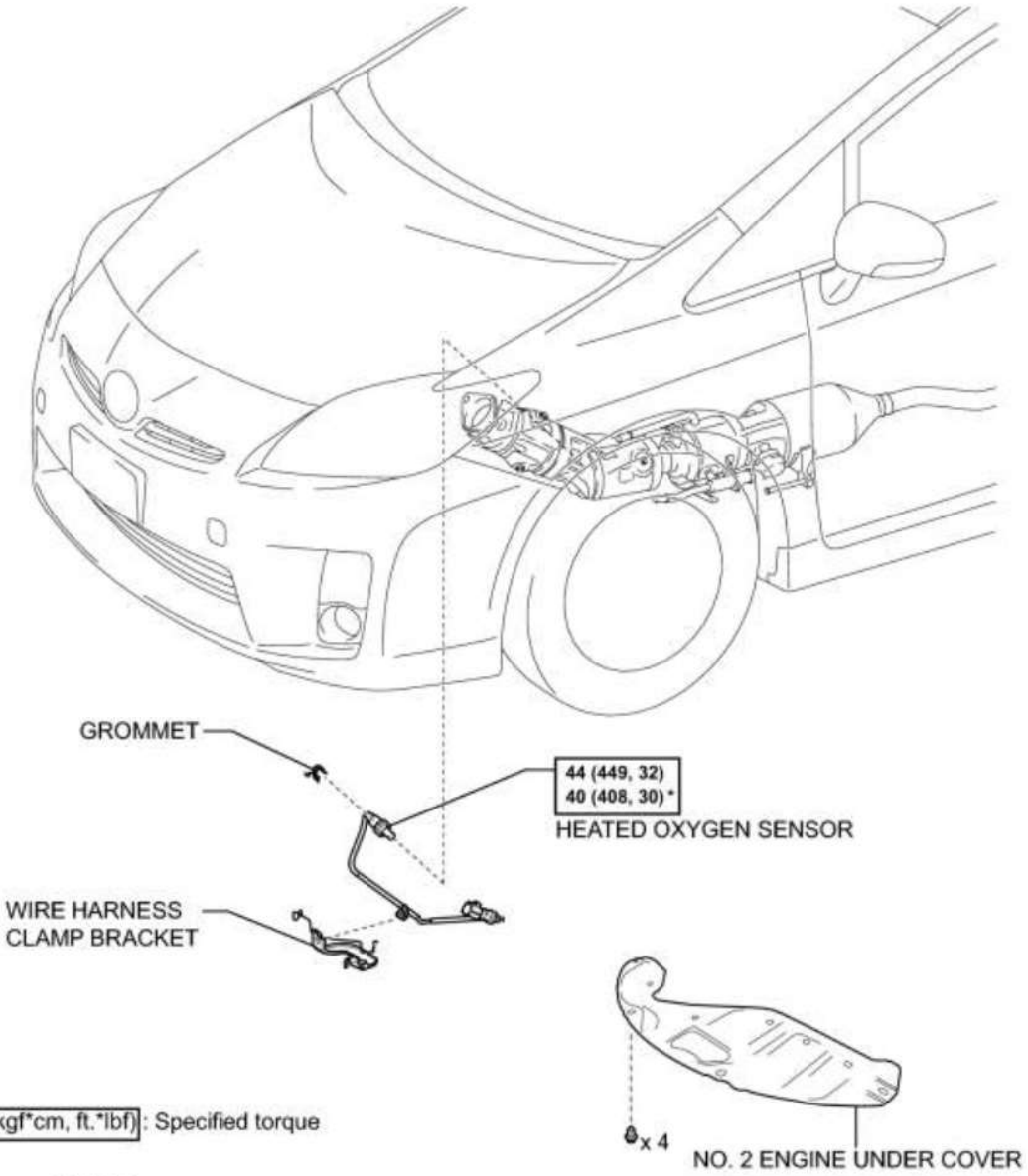
3. INSTALL EGR WITH COOLER PIPE SUB-ASSEMBLY

(a) Install the EGR with cooler pipe sub-assembly INFO.

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COMPONENTS

ILLUSTRATION

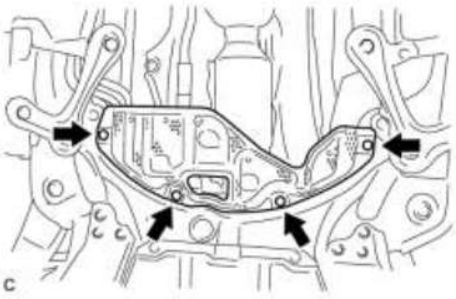


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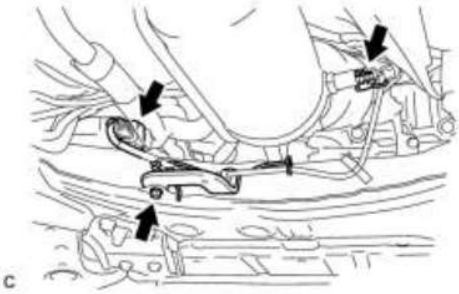
REMOVAL

1. REMOVE NO. 2 ENGINE UNDER COVER



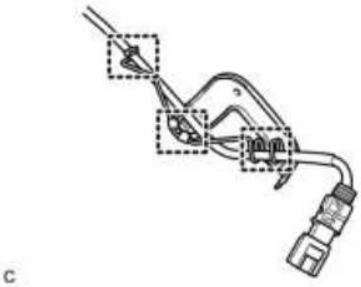
(a) Remove the 4 clips and No. 2 engine under cover.

2. REMOVE HEATED OXYGEN SENSOR



(a) Disconnect the heated oxygen sensor connector.

(b) Remove the grommet and pull the sensor connector out of the cabin through the floor panel.

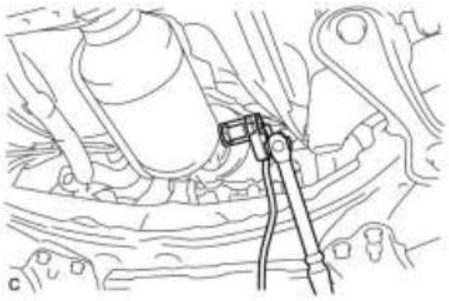


(c) Remove the wire harness clamp bracket and disconnect the wire harness clamp.

(d) Using SST, remove the heated oxygen sensor.

SST: 09224-00010

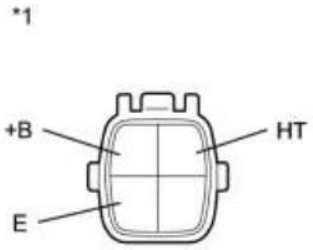
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INSPECTION

1. INSPECT HEATED OXYGEN SENSOR



Text in Illustration

*1	Component without harness connected (Heated Oxygen Sensor)

(a) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
(HT) - (+B)	20°C (68°F)	11 to 16 Ω
(HT) - (E)	-	10 kΩ or higher

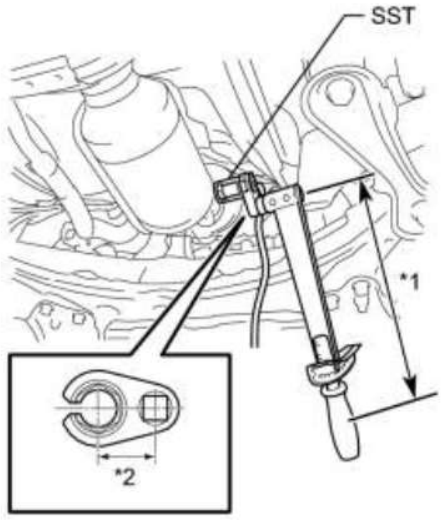
If the result is not as specified, replace the heated oxygen sensor.

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INSTALLATION

1. INSTALL HEATED OXYGEN SENSOR

(a) Using SST, install the heated oxygen sensor onto the front exhaust pipe.



Text in Illustration

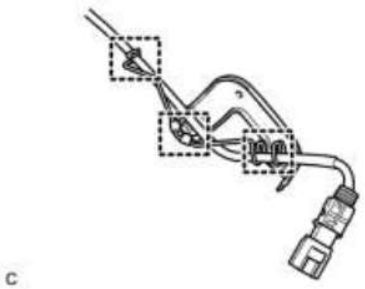
*1	Fulcrum Length
*2	30 mm

SST: 09224-00010

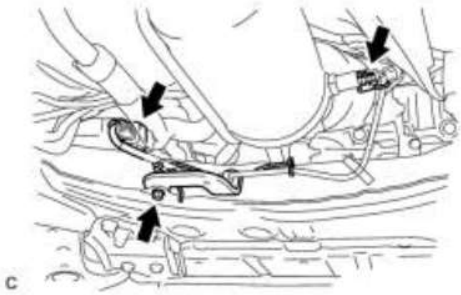
without SST - Torque: **44 N·m (449 kgf·cm, 32ft·lbf)**

with SST - Torque: **40 N·m (408 kgf·cm, 30ft·lbf)**

- This torque value can be obtained by using a torque wrench with a fulcrum length of 300 mm (11.81 in.) and SST with a length of 30 mm (1.18 in.) INFO.
- This torque value is effective when SST is parallel to the torque wrench.



(b) Install the wire harness clamp bracket and connect the wire harness clamp.



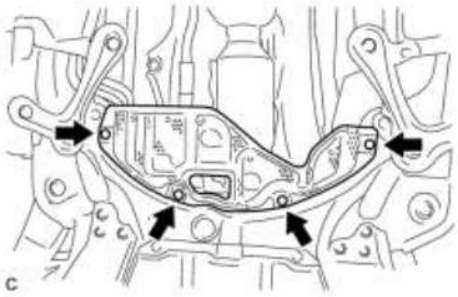
(c) Pass the sensor connector through the floor panel and install the grommet.

(d) Connect the heated oxygen sensor connector.

2. INSPECT FOR EXHAUST GAS LEAK

3. INSTALL NO. 2 ENGINE UNDER COVER

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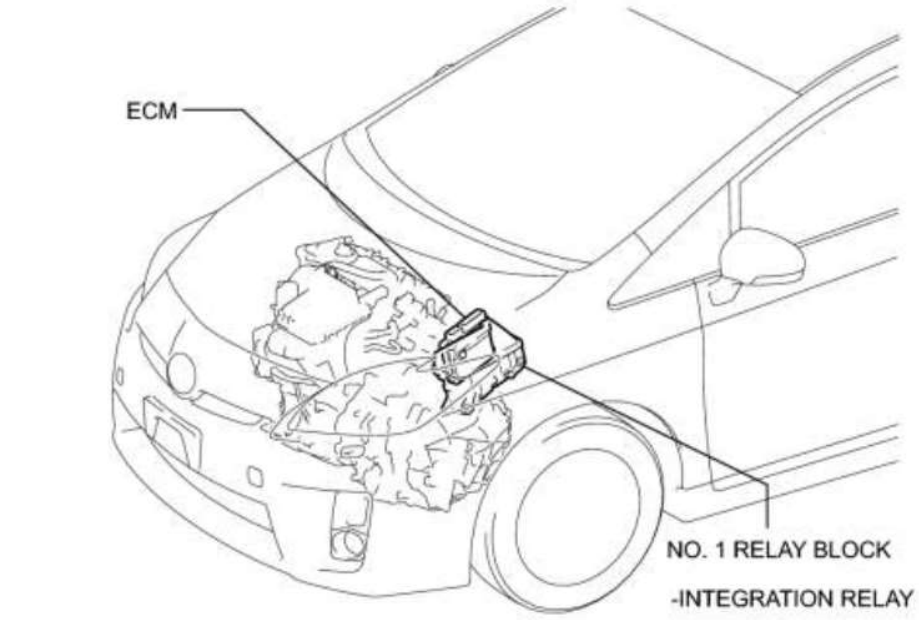


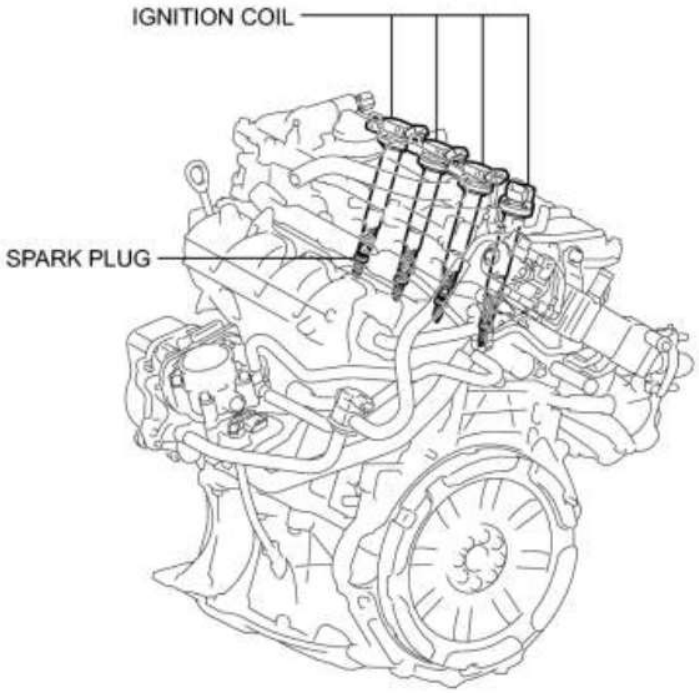
(a) Install the No. 2 engine under cover with the 4 clips.

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PARTS LOCATION

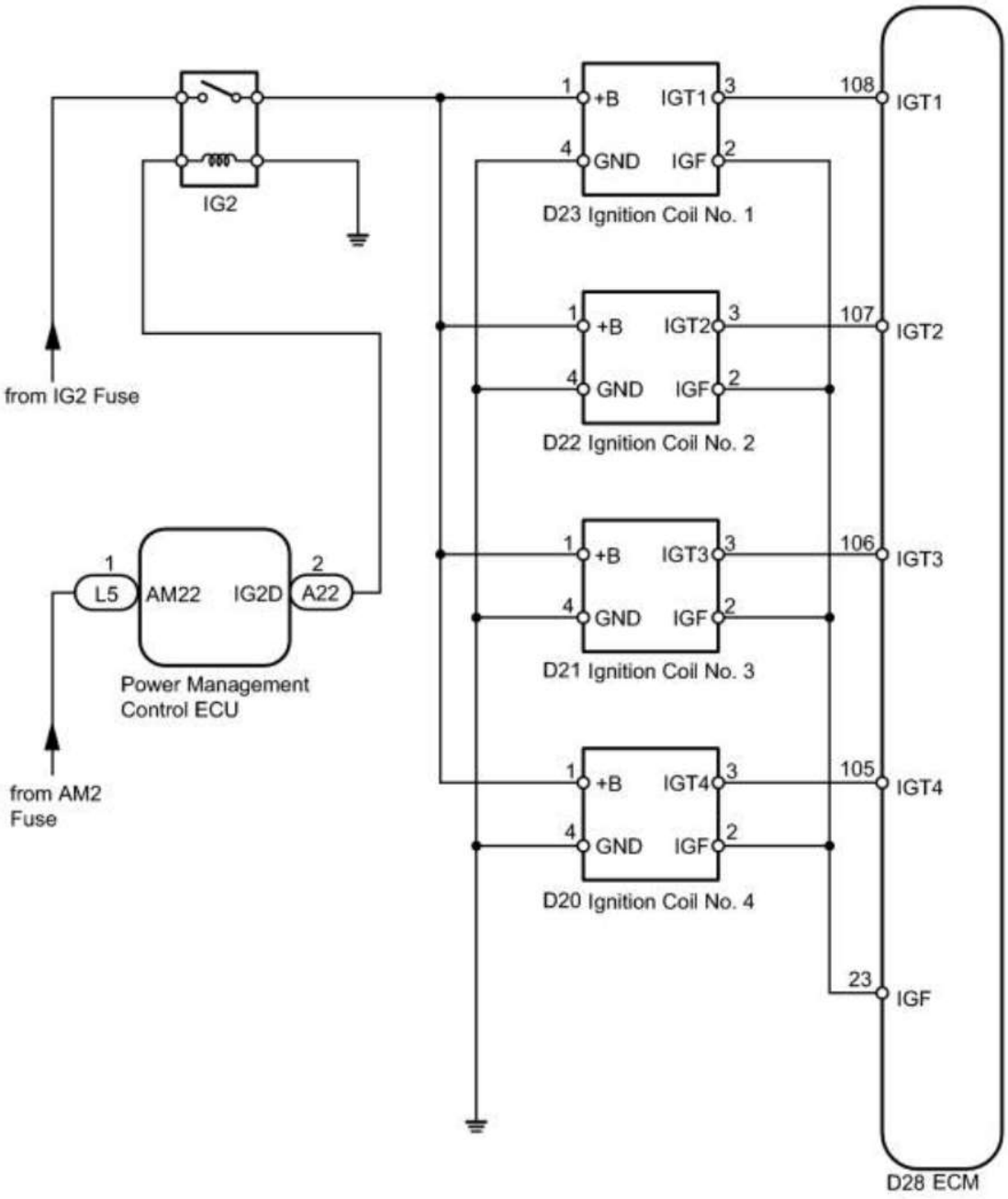
ILLUSTRATION





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SYSTEM DIAGRAM



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ON-VEHICLE INSPECTION

1. CHECK IGNITION COIL ASSEMBLY AND PERFORM SPARK TEST

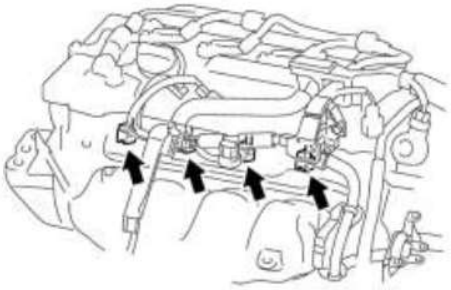
(a) Check for DTCs INFO.

NOTICE:

If any DTC is present, perform troubleshooting in accordance with the procedure for that DTC.

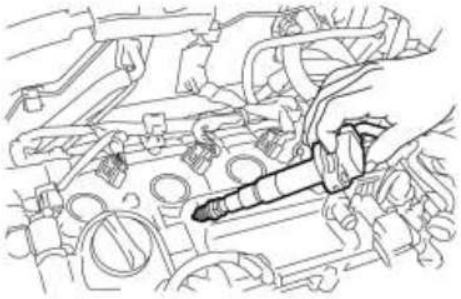
(b) Check that spark occurs.

(1) Remove the ignition coils and spark plugs INFO.



(2) Disconnect the 4 fuel injector connectors.

(3) Set the vehicle to the inspection mode INFO.



(4) Install the spark plug into the ignition coil, and then connect the ignition coil connector. (step 4)

(5) Ground the spark plug. (step 5)

(6) Check that spark occurs while the engine is being cranked. (step 6)

HINT:

Repeat steps 4 to 6 for each spark plug and ignition coil.

NOTICE:

- Ground the spark plugs when checking them.
- Replace any ignition coils that have been subjected to a physical impact.
- Do not crank the engine for more than 2 seconds.

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If spark does not occur, perform the following procedure for the malfunctioning cylinder.

(c) Perform the following spark test procedure.

(1) Check that the ignition coil connector is securely connected.

Result:

Result	Action
NG	Connect securely
OK	Go to next step

(2) Perform a spark test.

1. Replace the ignition coil with a known good one.
2. Set the vehicle to the inspection mode INFO.
3. Perform the spark test again.

Result:

Result	Action
NG	Go to next step
OK	Replace ignition coil

(3) Perform a spark test.

1. Replace the spark plug with a known good one.
2. Set the vehicle to the inspection mode INFO.
3. Perform the spark test again.

Result:

Result	Action
NG	Go to next step
OK	Replace the spark plug

(4) Check the power supply.

Text in Illustration

*1	Front view of wire harness connector (to Ignition Coil)

1. Turn the power switch on (IG).
2. Measure the voltage according to the value(s) in the table below.

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*1

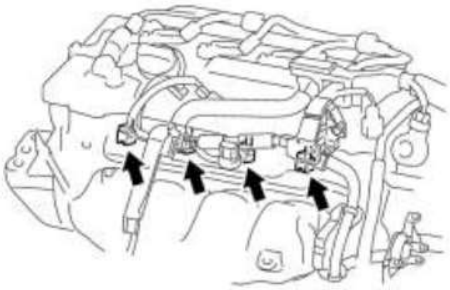
Standard Voltage:

Tester Connection	Condition	Specified Cond
1 (+B) - 4 (GND)	Power switch on (IG)	11 to 14 V



Result:

Result	Action
NG	Check wiring between battery and ignition coil and check g circuit
OK	Replace the ECM INFO



(5) Connect the 4 fuel injector connectors.

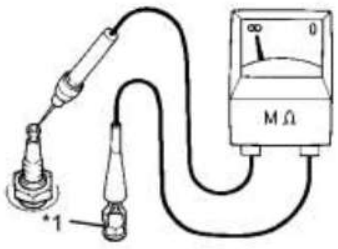
(6) Install the ignition coils and spark plugs INFO.

2. INSPECT SPARK PLUG

(a) Check the electrode.

Text in Illustration

*1	Ground



(1) Using a megohmmeter, measure the resistance.

Standard Resistance:

10 MΩ or more

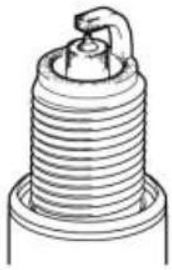
If the result is 10 MΩ or less, clean the plug and measure the resistance again.

HINT:

If a megohmmeter is not available, perform the following simple inspection instead.

(b) Alternative inspection method:

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(1) Quickly accelerate the engine to 4000 rpm 5 times.

(2) Remove each spark plug.

(3) Visually check the spark plug.

If the electrode is dry, the spark plug is functioning properly. If the electrode is damp, proceed to the next step.

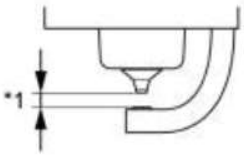
(c) Check the spark plug for any damage to its threads and insulator.

If there is any damage, replace the spark plug.

Recommended Spark Plug

Manufacturer	Spark Plug Type
DENSO	SC20HR11

(d) Check the spark plug electrode gap.



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Text in Illustration

*1	Spark Plug Electrode Gap

Maximum Electrode Gap for Used Spark Plug:

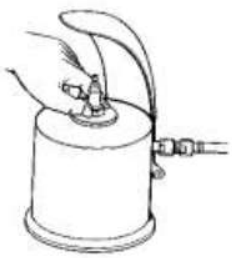
Electrode Gap
1.3 mm (0.0512 in.)

If the gap is greater than the maximum, replace the spark plug.

Electrode Gap for New Spark Plug:

Electrode Gap
1.0 to 1.1 mm (0.0394 to 0.0433 in.)

(e) Clean the spark plugs.



If the electrode has traces of wet carbon, clean the electrode with a spark plug cleaner and then dry it.

Standard air pressure:

588 kPa (6.0 kgf/cm^2, 85 psi)

Standard duration:

20 seconds or less.

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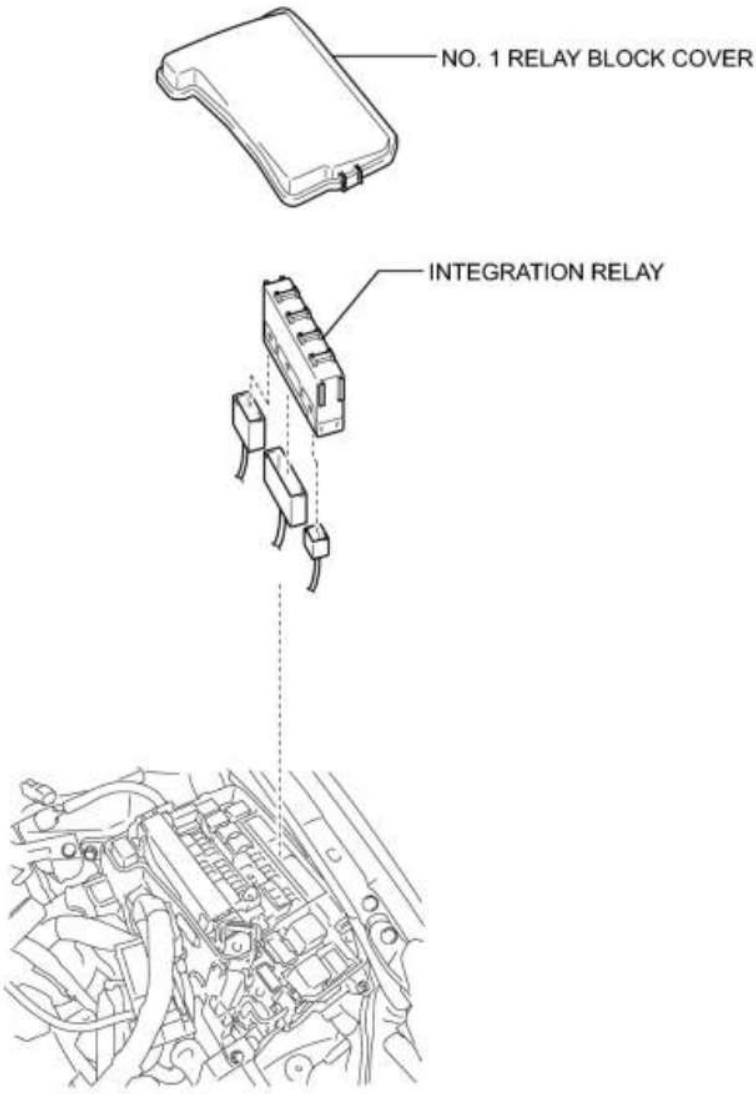
HINT:

Only use the spark plug cleaner when the electrode is free of oil. If the electrode has traces of oil, use gasoline to clean off the oil before using the spark plug cleaner.

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COMPONENTS

ILLUSTRATION



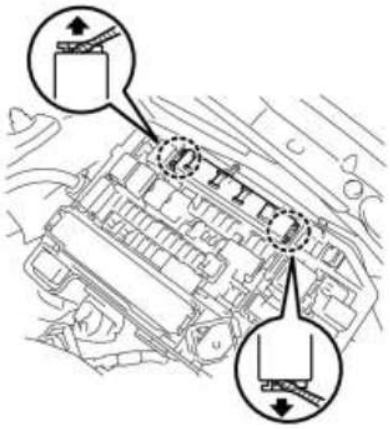
c

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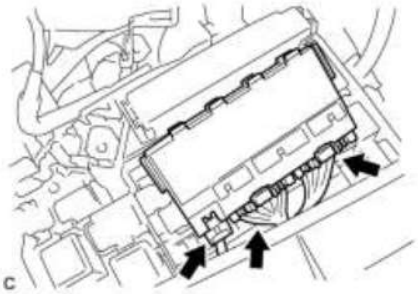
REMOVAL

1. REMOVE NO. 1 RELAY BLOCK COVER

2. REMOVE NO.1 INTEGRATION RELAY



(a) Using a screwdriver with its tip wrapped in protective tape, disengage the 2 claws and disconnect the integration relay.

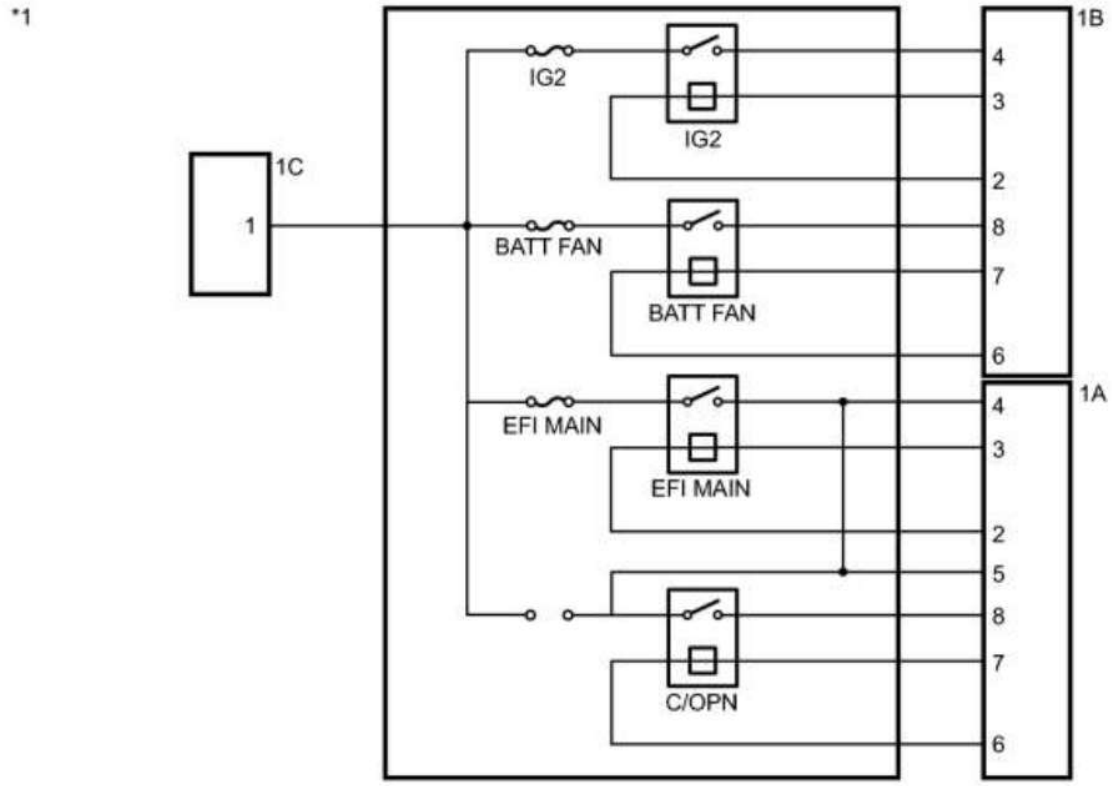


(b) Disconnect the 3 connectors and remove the integration relay.

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INSPECTION

1. INSPECT INTEGRATION NO.1 RELAY

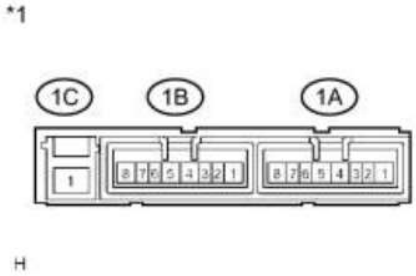


Text in Illustration

*1	Integration Relay	-	-

(a) IG2 RELAY:

(1) Measure the resistance according to the value(s) in the table below.



Text in Illustration

*1	Integration Relay

Standard Resistance:

Tester Connection	Condition	Specified Condition
Integration relay (1C-1) - Integration relay (1B-4)	Battery voltage is not applied between terminals 1B-3 and 1B-2	10 kΩ or higher

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Integration relay (1C-1) - Integration relay (1B-4)	Battery voltage is applied between terminals 1B-3 and 1B-2	Below 1 Ω

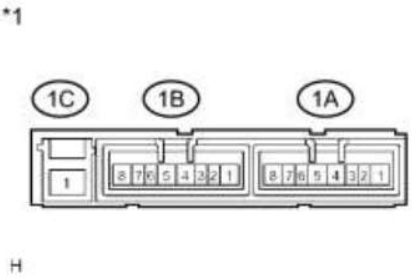
If the resistance is not as specified, replace the integration relay.

(b) EFI MAIN RELAY:

(1) Measure the resistance according to the value(s) in the table below.

Text in Illustration

*1	Integration Relay



Standard Resistance:

Tester Connection	Condition	Specified Condition
Integration relay (1C-1) - Integration relay (1A-4)	Battery voltage is not applied between terminals 1A-2 and 1A-3	10 kΩ or higher
Integration relay (1C-1) - Integration relay (1A-4)	Battery voltage is applied between terminals 1A-2 and 1A-3	Below 1 Ω

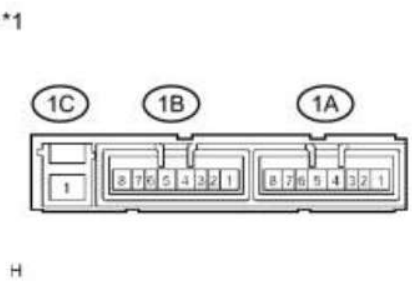
If the resistance is not as specified, replace the integration relay.

(c) C/OPN RELAY:

(1) Measure the resistance according to the value(s) in the table below.

Text in Illustration

*1	Integration Relay



Standard Resistance:

Tester Connection	Condition	Specified Condition
Integration relay (1A-5) - Integration relay (1A-8)	Battery voltage is not applied between terminals 1A-6 and 1A-7	10 kΩ or higher
Integration relay (1A-5) - Integration relay (1A-8)	Battery voltage is applied between terminals 1A-6 and 1A-7	Below 1 Ω

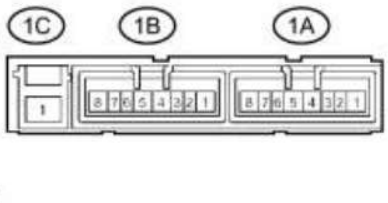
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If the resistance is not as specified, replace the integration relay.

(d) BATT FAN RELAY:

(1) Measure the resistance according to the value(s) in the table below.

*1



H

Text in Illustration

*1	Integration Relay

Standard Resistance:

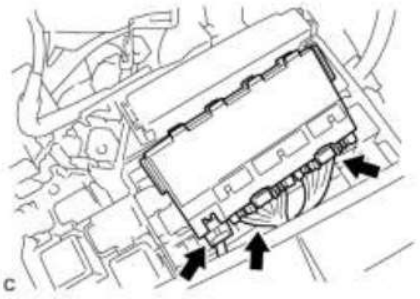
Tester Connection	Condition	Specified Condition
Integration relay (1C-1) - Integration relay (1B-8)	Battery voltage is not applied between terminals 1B-7 and 1B-6	10 kΩ or higher
Integration relay (1C-1) - Integration relay (1B-8)	Battery voltage is applied between terminals 1B-7 and 1B-6	Below 1 Ω

If the resistance is not as specified, replace the integration relay.

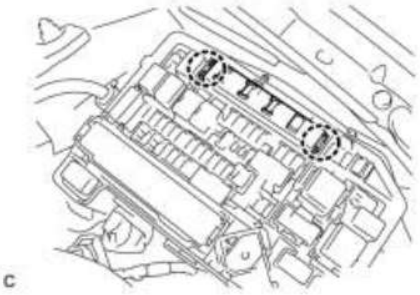
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INSTALLATION

1. INSTALL NO.1 INTEGRATION RELAY



(a) Connect the 3 connectors.



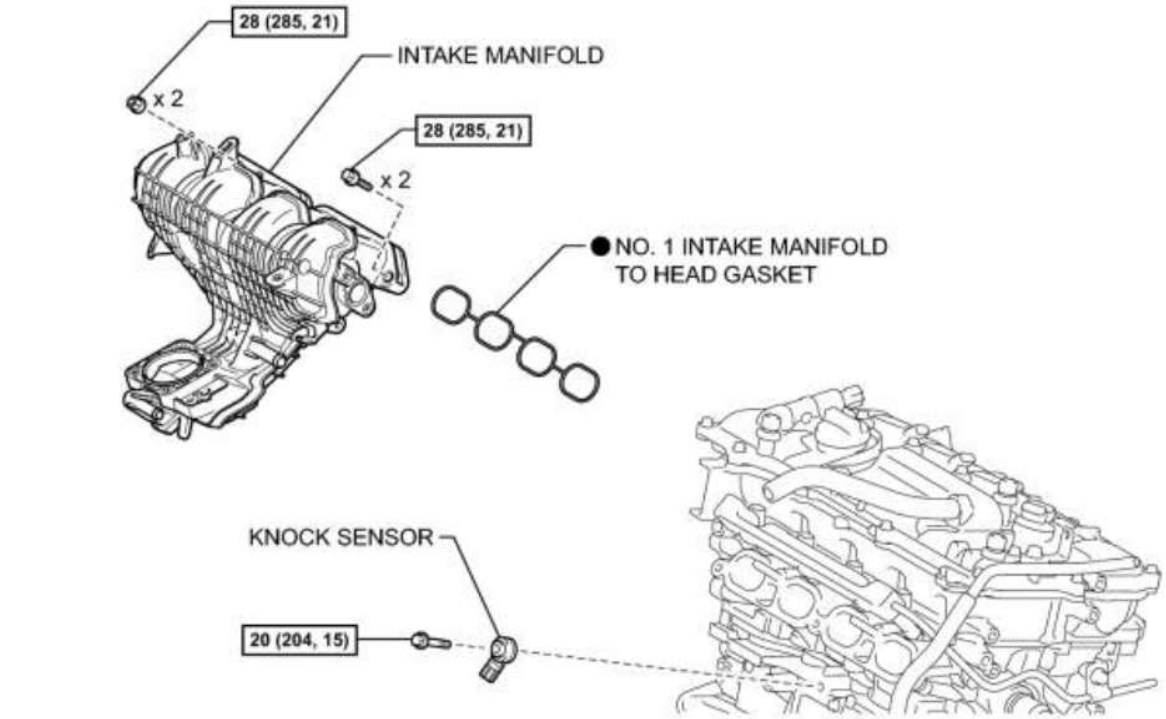
(b) Attach the integration relay to the engine room relay block.

2. REMOVE NO. 1 RELAY BLOCK COVER

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COMPONENTS

ILLUSTRATION



N*m (kgf*cm, ft.*lbf): Specified torque

● Non-reusable part

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REMOVAL

1. REMOVE INTAKE MANIFOLD

(a) Remove the intake manifold INFO.

2. REMOVE KNOCK SENSOR

(a) Disconnect the knock sensor connector.

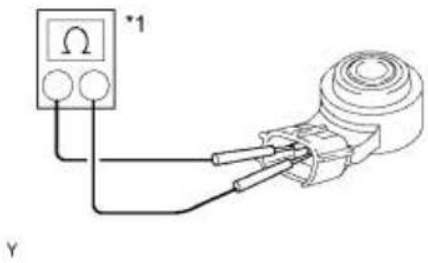


(b) Remove the bolt and remove the knock sensor.

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INSPECTION

1. INSPECT KNOCK SENSOR



Text in Illustration

*1	Ohmmeter

(a) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

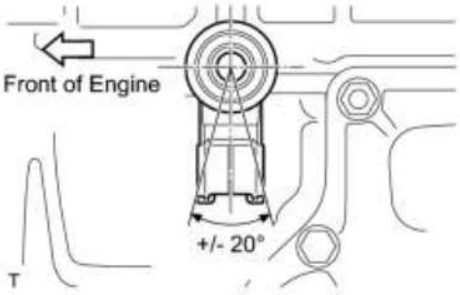
Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	120 to 280 kΩ

If the result is not as specified, replace the knock sensor.

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INSTALLATION

1. INSTALL KNOCK SENSOR



(a) Install the knock sensor with the bolt as shown in the illustration.

Torque: **20 N·m (204 kgf·cm, 15ft·lbf)**

NOTICE:

Make sure that the knock control sensor is in the correct position.

(b) Connect the knock sensor connector.

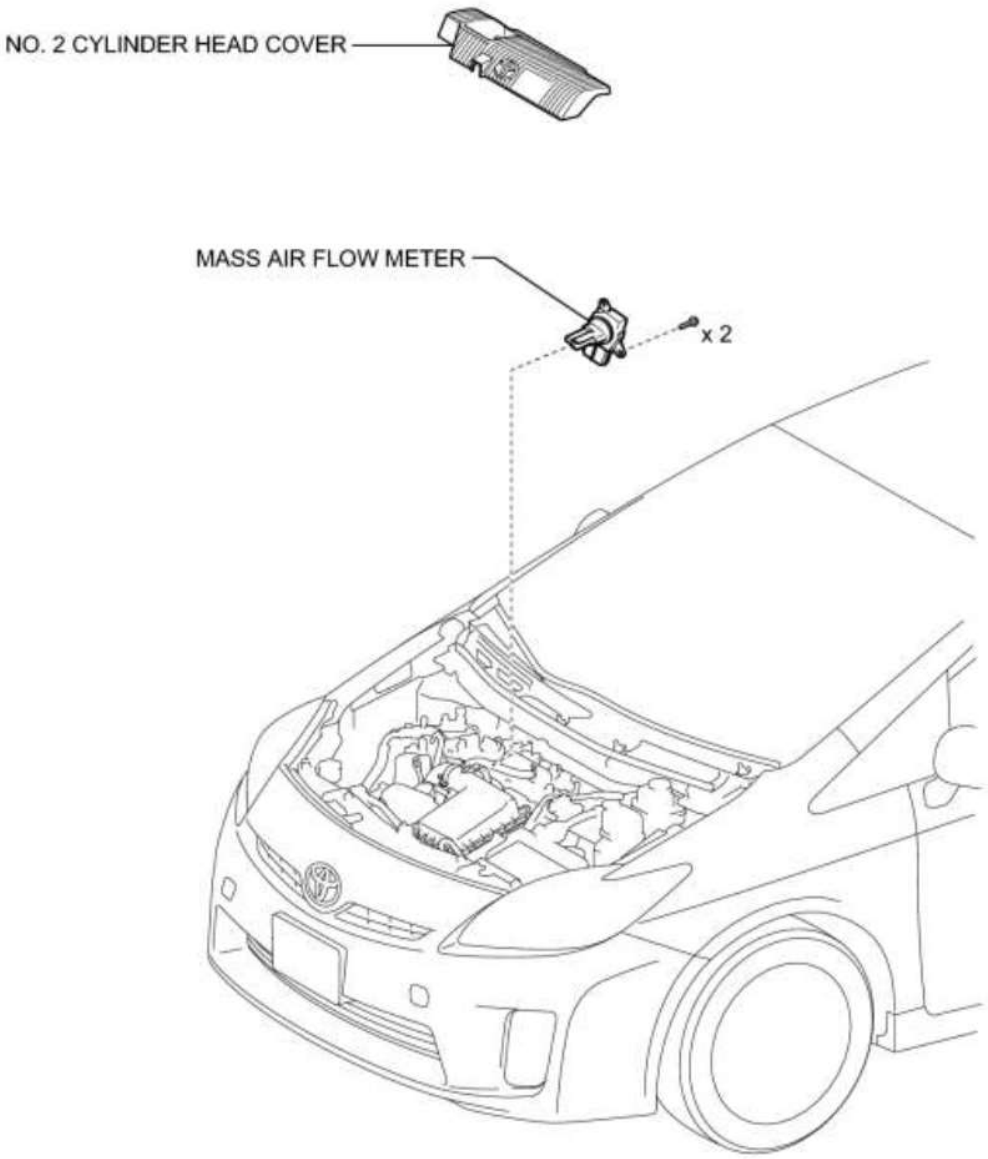
2. INSTALL INTAKE MANIFOLD

(a) Install the intake manifold INFO.

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COMPONENTS

ILLUSTRATION



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ON-VEHICLE INSPECTION

NOTICE:

- Perform the mass air flow meter inspection in accordance with the following procedure.
- Replace the mass air flow meter only when foreign matter adheres to the sensor and the MAF value in the Data List (with the engine stopped) is not within the normal operating range.

1. INSPECT MASS AIR FLOW METER

(a) Read the values using the Techstream (MAF).

NOTICE:

- Perform the inspection with the vehicle indoors and on a level surface.
- Perform the inspection of the mass air flow meter while it is installed into the air cleaner case (installed on the vehicle).
- During the test, do not use an exhaust air duct on the exhaust pipe.

(1) Connect the Techstream to the DLC3.

(2) Turn the power switch on (IG) (do not run the engine).

(3) Turn the Techstream on.

(4) Enter the following menus: Powertrain / Engine and ECT / Data List / MAF.

(5) Wait 30 seconds, and read the values on the Techstream.

Standard Condition:

Tester Display	Condition	Standard Condition
MAF	• Engine not running • 30 seconds after power switch is turned on (IG)	Less than 0.25 g/sec

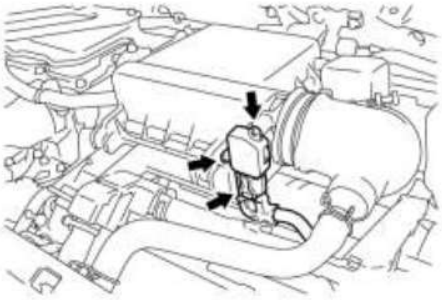
- If the result is not as specified, replace the mass air flow meter.
- If the result is within the specified range, remove and inspect the mass air flow meter INFO.

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REMOVAL

1. REMOVE NO. 2 CYLINDER HEAD COVER INFO

2. REMOVE MASS AIR FLOW METER



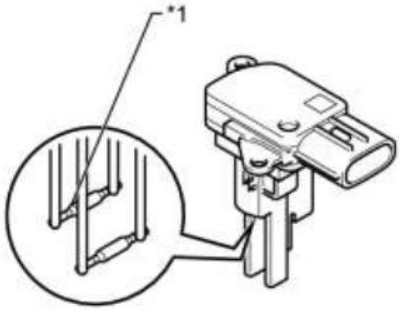
(a) Disconnect the mass air flow meter connector.

(b) Remove the 2 screws and the mass air flow meter.

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INSPECTION

1. INSPECT MASS AIR FLOW METER



(a) Perform a visual check for any foreign matter on the platinum hot wire (heater) of the mass air flow meter shown in the illustration.

Text in Illustration

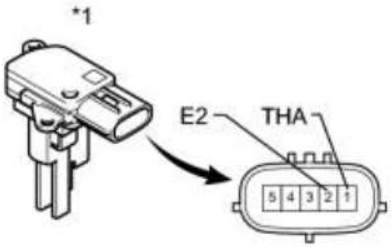
*1	Platinum Hot Wire (Heater)

Result:

There is no foreign matter.

If the result is not as specified, replace the mass air flow meter.

(b) Measure the resistance according to the value(s) in the table below.



Text in Illustration

*1	Mass Air Flow Meter

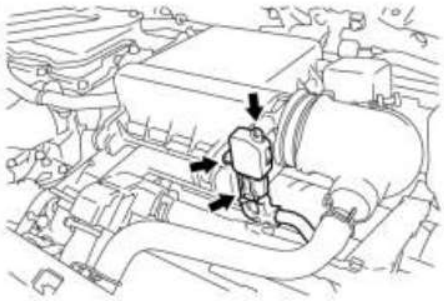
Standard Resistance:

Tester Connection	Condition	Specified Condition
1 (THA) - 2 (E2)	-20°C (-4°F)	13.6 to 18.4 kΩ
	20°C (68°F)	2.21 to 2.69 kΩ
	60°C (140°F)	0.49 to 0.67 kΩ

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INSTALLATION

1. INSTALL MASS AIR FLOW METER



(a) Install the mass air flow meter with the 2 screws.

NOTICE:

Make sure that the O-ring is not cracked or does not jump out of position during installation.

(b) Connect the mass air flow meter connector.

2. INSTALL NO. 2 CYLINDER HEAD COVER INFO

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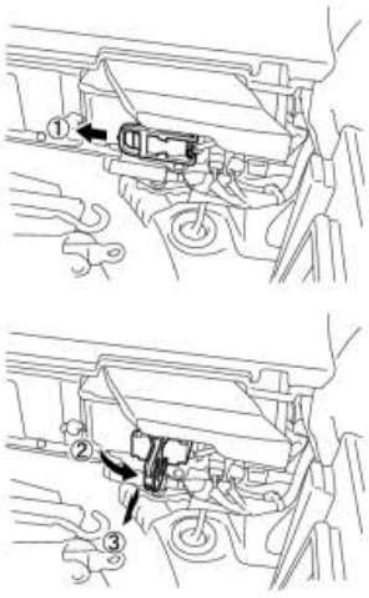
PRECAUTION

1. PRECAUTIONS FOR INSPECTING HYBRID CONTROL SYSTEM

(a) Before inspecting the high-voltage system or disconnecting the low voltage connector of the inverter with converter assembly, take safety precautions such as wearing insulated gloves and removing the service plug grip to prevent electrical shocks. After removing the service plug grip, put it in your pocket to prevent other technicians from accidentally reconnecting it while you are working on the high-voltage system.

NOTICE:

After removing the service plug grip, turning the power switch on (READY) may cause a malfunction. Do not turn the power switch on (READY) unless instructed by the repair manual.



C

(b) After disconnecting the service plug grip, wait for at least 10 minutes before touching any of the high-voltage connectors or terminals.

HINT:

Waiting for at least 10 minutes is required to discharge the high-voltage capacitor inside the inverter with converter assembly.

2. NOTICE FOR HYBRID CONTROL SYSTEM ACTIVATION

(a) When the warning light is illuminated, or the auxiliary battery has been disconnected and reconnected, attempting to turn the power switch on (READY) may not start the system (the system may not enter the READY-on state) on the first attempt. If so, turn the power switch off and reattempt to start the hybrid system.

3. FOR USING TECHSTREAM

CAUTION:

Observe the following items for safety reasons:

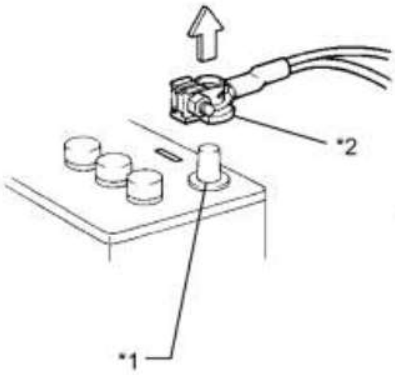
- Before using the Techstream, read the instruction manual.
- Prevent the Techstream cable from being caught on the pedals, shift lever or steering wheel when driving with the Techstream connected to the vehicle.
- When driving the vehicle for testing purposes using the Techstream, 2 persons are required. One is for driving the vehicle, and the other operates the Techstream.

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4. DISCONNECTING AND RECONNECTING NEGATIVE BATTERY CABLE

(a) Before performing work on electronic components, disconnect the cable from the negative (-) battery terminal to prevent damage to the electrical system or electrical components.

Text in Illustration



*1	Negative (-) Battery Terminal
*2	Cable

(b) Before disconnecting and reconnecting the battery cable, turn the power switch off and the headlight switch off. Then loosen the terminal nut completely. Do not damage the cable or terminal.

(c) When the battery cable is disconnected, the clock and radio settings and stored DTCs are cleared. Therefore, before disconnecting the battery cable, make a note of them.

- When the cable is disconnected from the negative (-) battery terminal, initialize the following system(s) after the cable is reconnected.

System Name	See Procedure
Advanced Parking Guidance System	INFO

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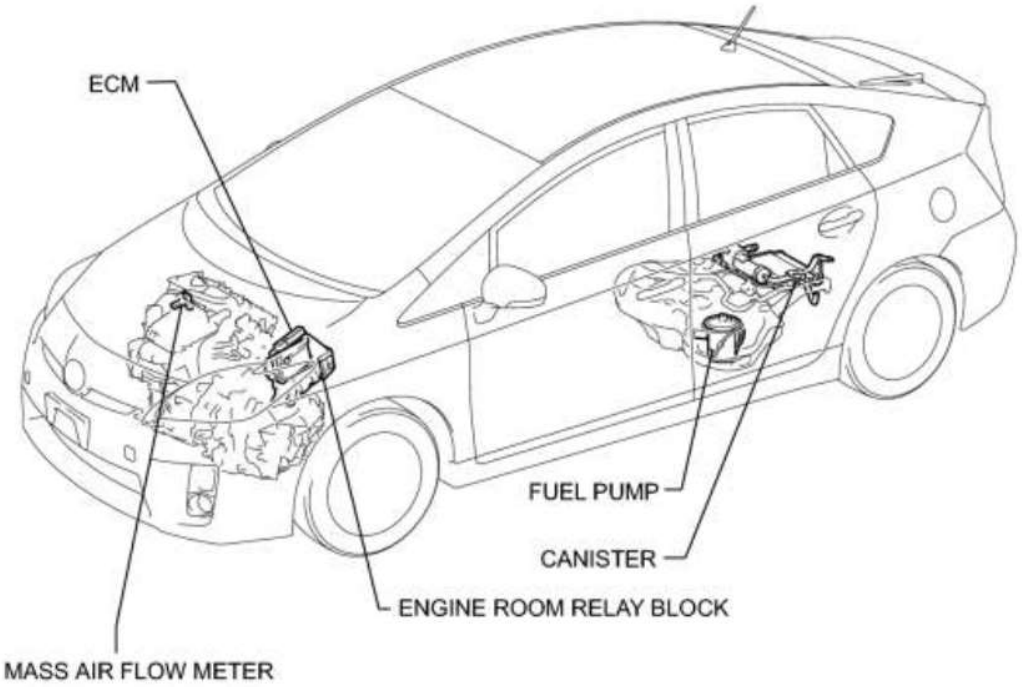
DEFINITION OF TERMS

Term	Definition
Monitor Description	Description of what the ECM monitors and how it detects malfunctions (monitoring purpose and its details).
Related DTCs	A group of diagnostic trouble codes that are output by the ECM based on the same malfunction detection logic.
Typical Enabling Condition	Preconditions that allow the ECM to detect malfunctions. With all preconditions satisfied, the ECM sets DTCs when monitored value(s) exceeds malfunction threshold(s).
Sequence of Operation	Order of monitor priority, applied if multiple sensors and components are involved in a single malfunction detection process. Each sensor and component is monitored in turn, when previous detection operation has completed.
Required Sensor/Components	The sensors and components used by the ECM to detect each malfunction.
Frequency of Operation	The number of times the ECM checks for each malfunction during each driving cycle. "Once per driving cycle" means ECM only performs checks for that malfunction once during a single driving cycle. "Continuous" means the ECM performs checks for that malfunction whenever enabling conditions are met.
Duration	Minimum time for which the ECM must detect a continuous deviation in monitored value(s) in order to set a DTC. Timing begins when Typical Enabling Conditions met.
Malfunction Thresholds	The value beyond which the ECM determines malfunctions exist and sets DTCs.
MIL Operation	Timing of MIL illumination after a malfunction is detected. "Immediate" means the ECM illuminates the MIL as soon as a malfunction is detected. "2 driving cycle" means the ECM illuminates the MIL if the same malfunction is detected a second time during the next sequential driving cycle.

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PARTS LOCATION

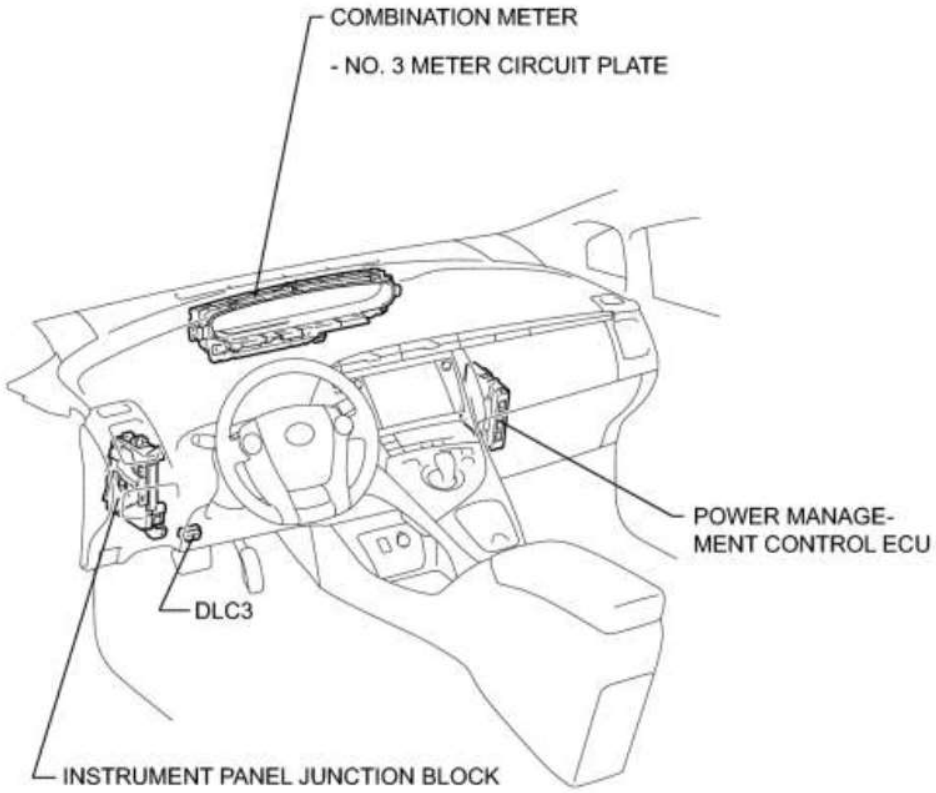
ILLUSTRATION



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P

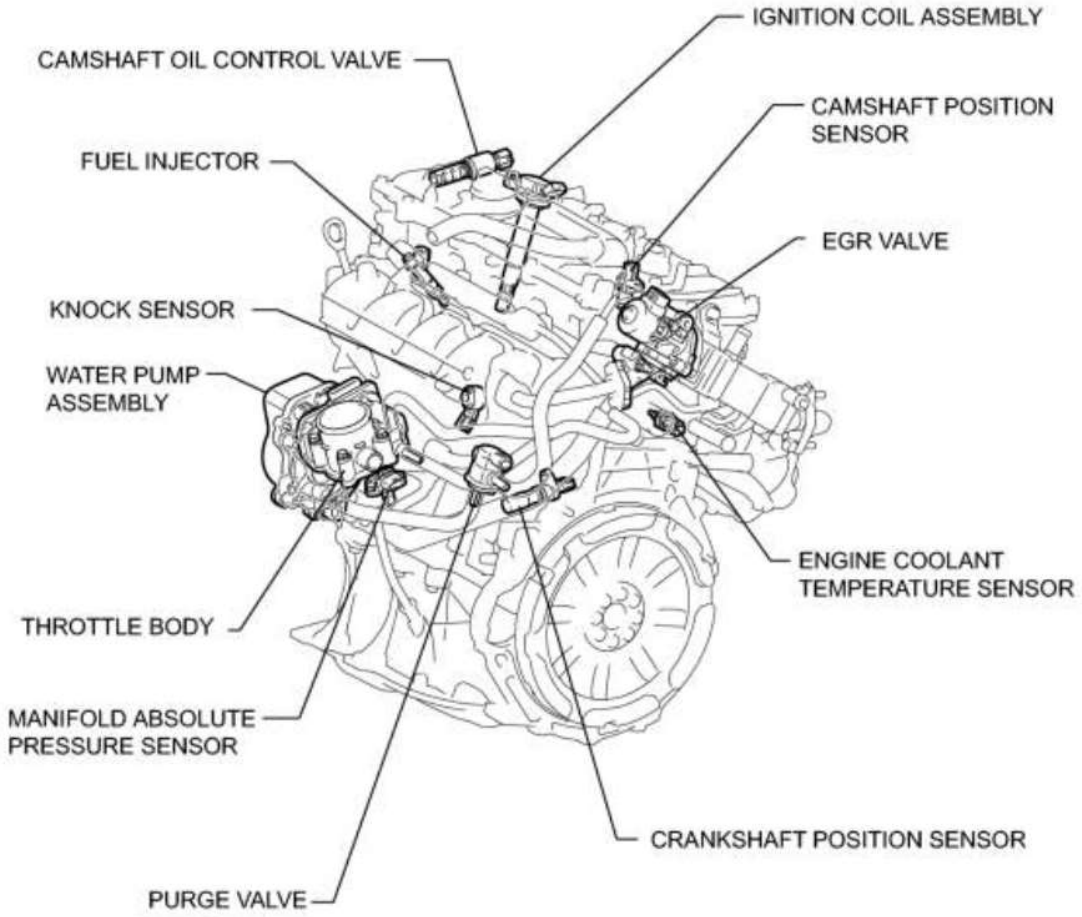
ILLUSTRATION



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ILLUSTRATION

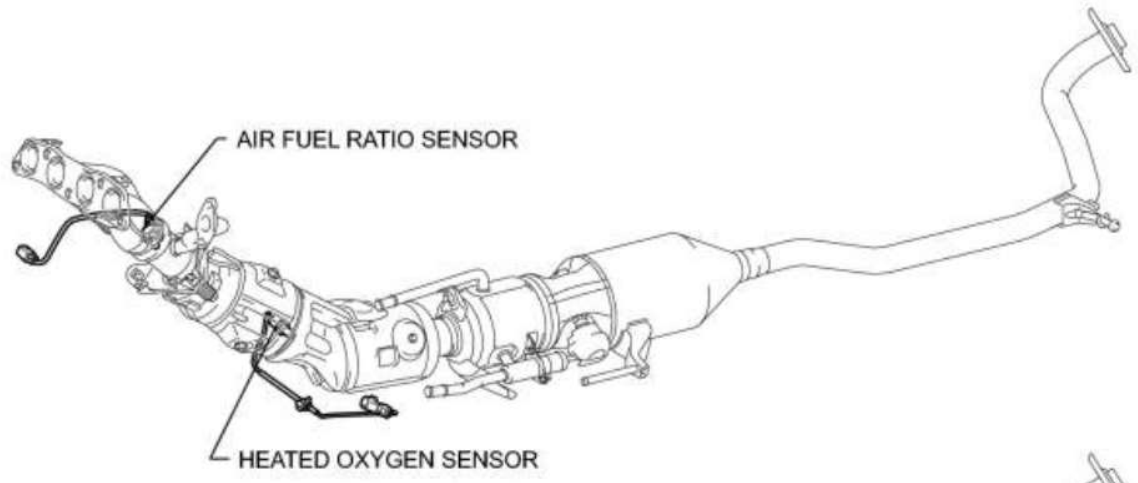


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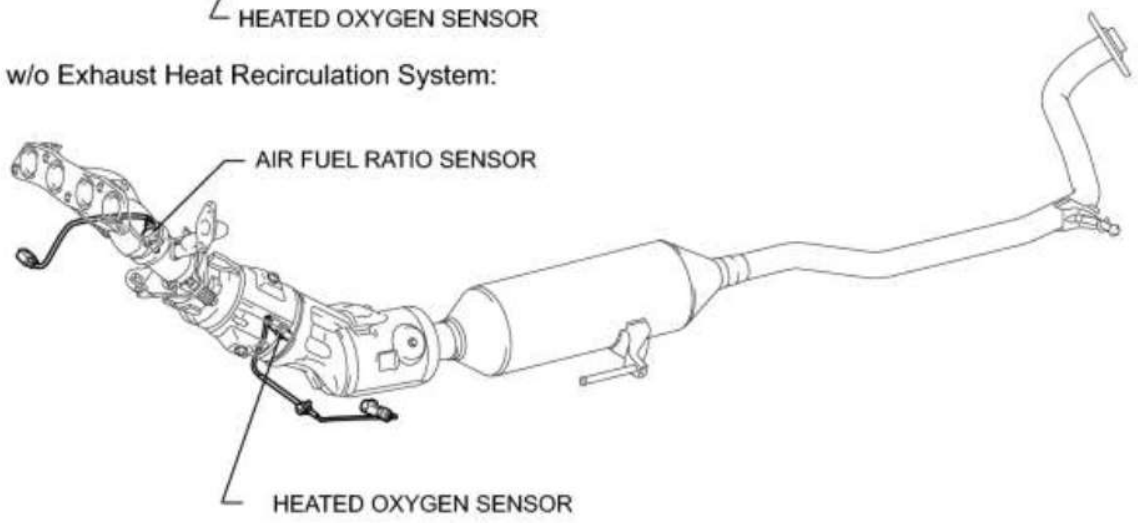
ILLUSTRATION

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w/ Exhaust Heat Recirculation System:



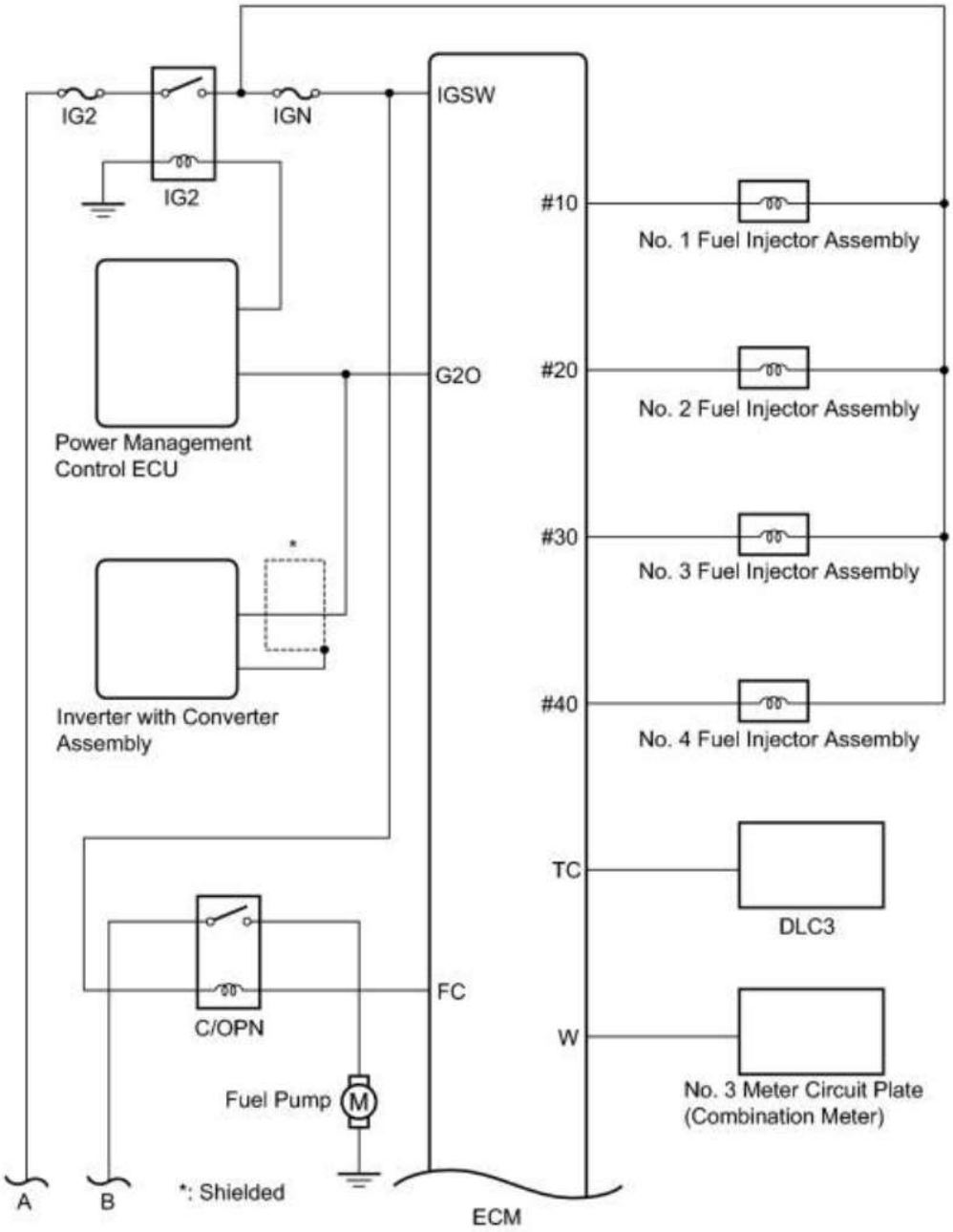
w/o Exhaust Heat Recirculation System:



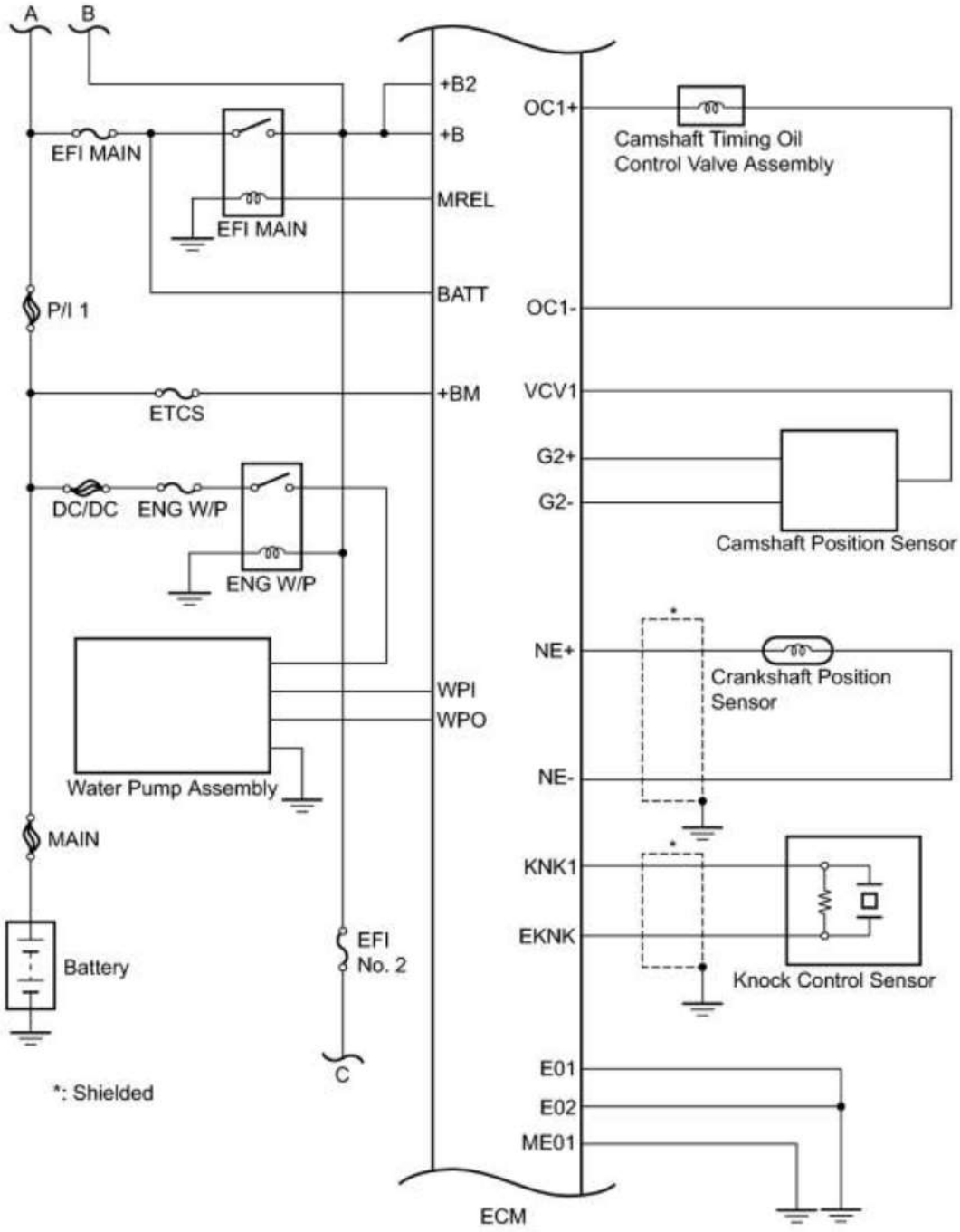
P

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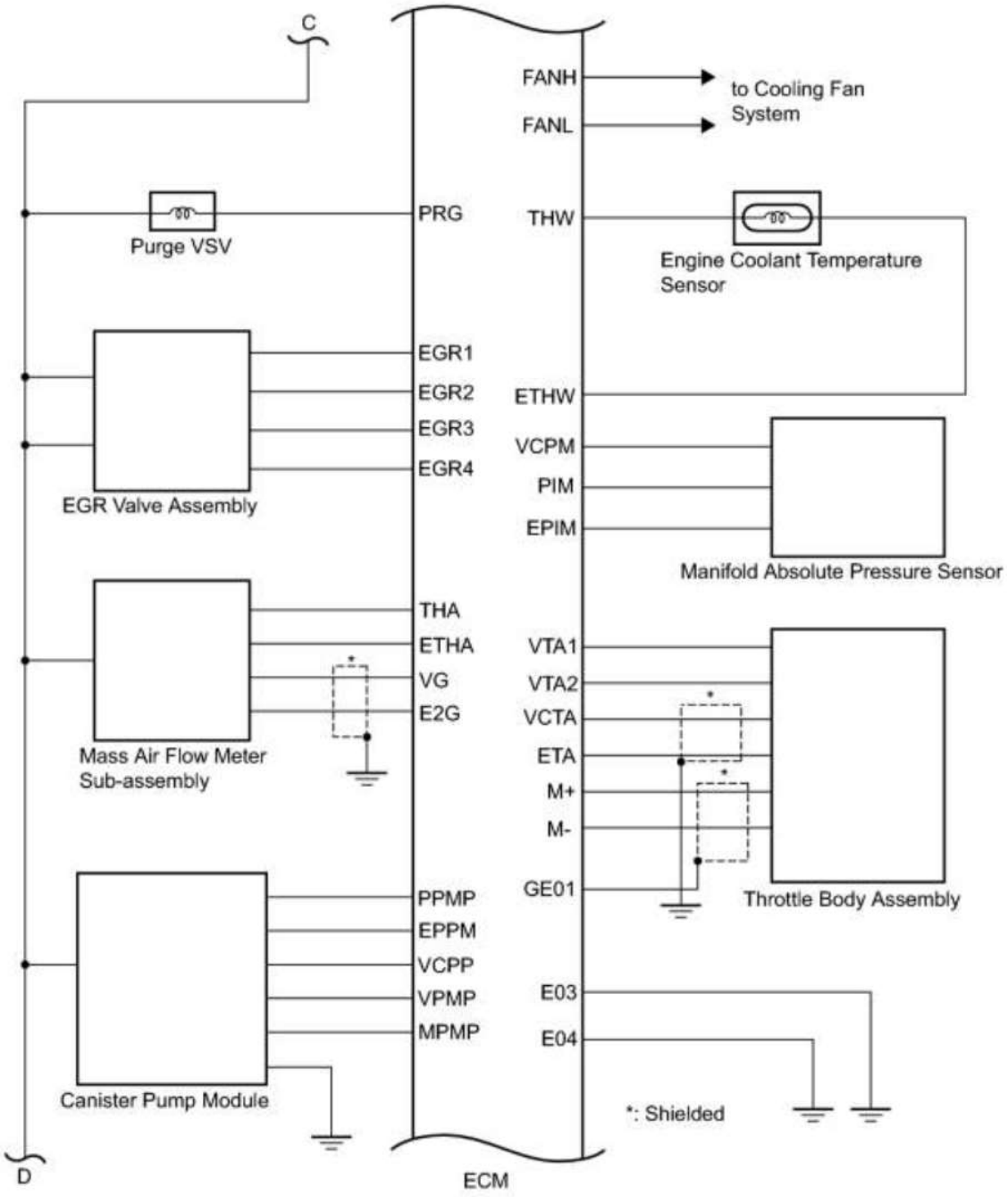
SYSTEM DIAGRAM



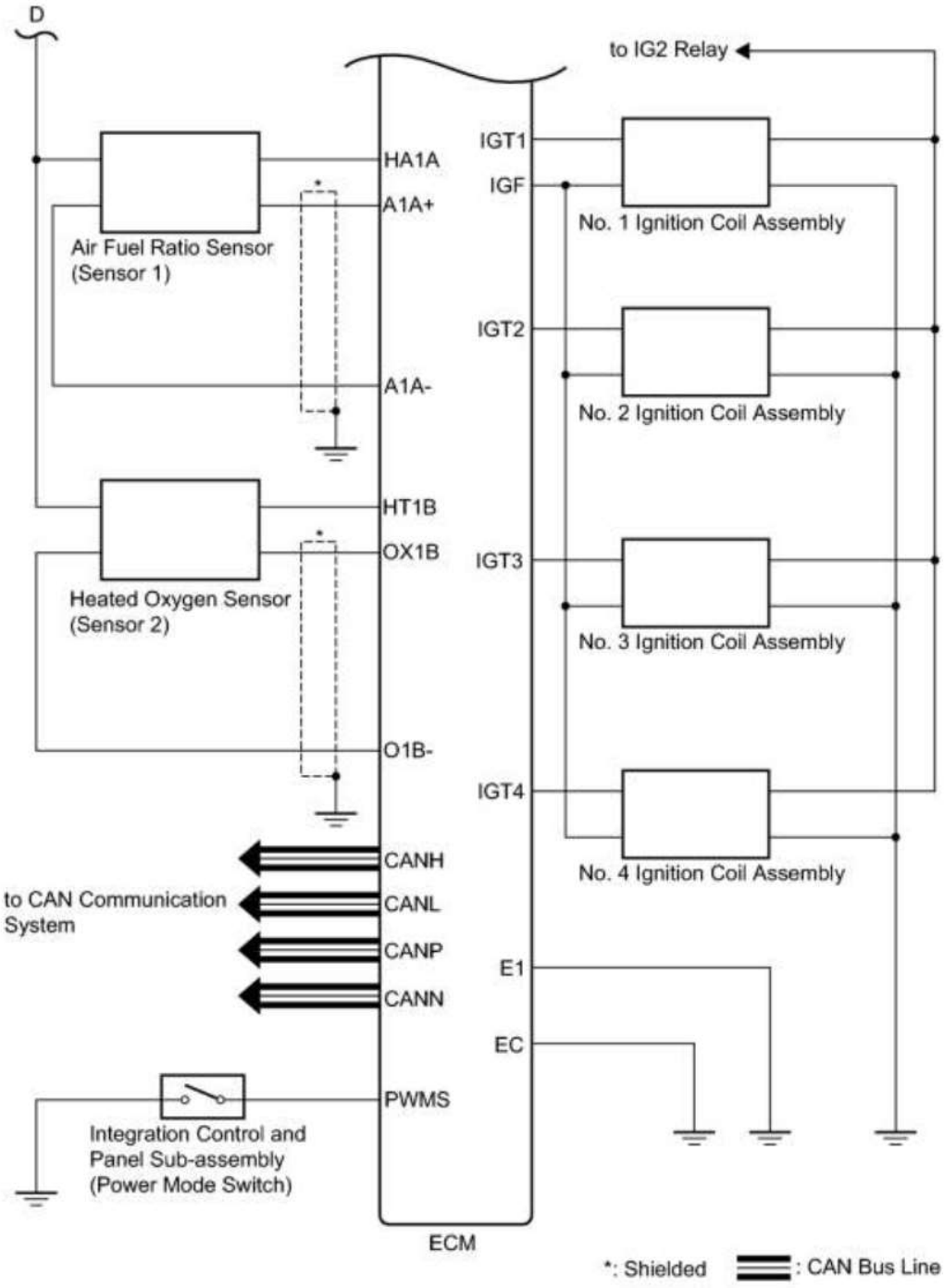
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HOW TO PROCEED WITH TROUBLESHOOTING

HINT:

*: Use the Techstream.

1.	VEHICLE BROUGHT TO WORKSHOP

NEXT

▼

2.	CUSTOMER PROBLEM ANALYSIS

NEXT

▼

3.	CONNECT TECHSTREAM TO DLC3

HINT:

If the display indicates a communication fault in the Techstream, inspect the DLC3.

NEXT

▼

4.	CHECK DTC AND FREEZE FRAME DATA*

HINT:

Record or print DTCs and freeze frame data, if necessary.

NEXT

▼

5.	CLEAR DTC AND FREEZE FRAME DATA*

NEXT

▼

6.	CONDUCT VISUAL INSPECTION

NEXT

▼

7.	SELECT CHECK MODE DIAGNOSIS*

NEXT

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8.	CONFIRM PROBLEM SYMPTOMS

HINT:

If the engine does not start, first perform the "Check DTC" procedures and "Conduct Basic Inspection" procedures below.

Result	Proceed to
Malfunction does not occur	A
Malfunction occurs	B

B GO TO STEP 10

A

9.	SIMULATE SYMPTOMS

HINT:

Refer to Problem Symptoms Table INFO.

NEXT

10.	CHECK DTC*

HINT:

Refer to DTC Check / Clear.

Result	Proceed to
Trouble code	A
No code	B

B GO TO STEP 12

A

11.	REFER TO DTC CHART

HINT:

Refer to Diagnostic Trouble Code Chart INFO.

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NEXT

12.	CONDUCT BASIC INSPECTION

HINT:

Refer to Basic Inspection INFO.

Result	Proceed to
Malfunctioning parts not confirmed	A
Malfunctioning parts confirmed	B

B GO TO STEP 17

A

13.	REFER TO PROBLEM SYMPTOMS TABLE

HINT:

Refer to Problem Symptoms Table INFO.

Result	Proceed to
Malfunctioning circuit confirmed	A
Malfunctioning parts confirmed	B

B GO TO STEP 17

A

14.	CHECK ECM POWER SOURCE CIRCUIT

HINT:

Refer to ECM Power Source Circuit INFO.

NEXT

15.	CONDUCT CIRCUIT INSPECTION

Result	Proceed to
Malfunction not confirmed	A

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Result	Proceed to
Malfunction confirmed	B

B GO TO STEP 18

A

16.	CHECK FOR INTERMITTENT PROBLEMS

NEXT

17.	CONDUCT PARTS INSPECTION

NEXT

18.	IDENTIFY PROBLEM

NEXT

19.	ADJUST AND/OR REPAIR

NEXT

20.	CONDUCT CONFIRMATION TEST

NEXT **END**

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CHECK FOR INTERMITTENT PROBLEMS

HINT:

Inspect the vehicle's ECM using check mode. Intermittent problems are easier to detect with the Techstream when the ECM is in check mode. In check mode, the ECM uses 1 trip detection logic, which is more sensitive to malfunctions than normal mode (default), which uses 2 trip detection logic.

1. Clear DTCs INFO.
2. Switch the ECM from normal mode to check mode using the Techstream INFO.
3. Perform a simulation test INFO.
4. Check and wiggle the harness(es), connector(s) and terminal(s) INFO.

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BASIC INSPECTION

When a malfunction is not confirmed by the DTC check, troubleshooting should be carried out in all circuits considered to be possible causes of the problem. In many cases, by carrying out the basic engine check shown in the following flowchart, the location of the problem can be found quickly and efficiently. Therefore, using this check is essential when troubleshooting the engine.

1.	CHECK BATTERY VOLTAGE

NOTICE:

Carry out this check with the engine stopped and the power switch off.

Result:

Result	Proceed to
11 V or more	OK
Below 11 V	NG

NG ▶ CHARGE OR REPLACE BATTERY

OK

▼

2.	CHECK WHETHER ENGINE CRANKS

NG ▶ INFO PROCEED TO PROBLEM SYMPTOMS TABLE

OK

▼

3.	CHECK WHETHER ENGINE STARTS

NG ▶ GO TO STEP 6

OK

▼

4.	CHECK AIR FILTER

(a) Visually check that the air filter is not excessively contaminated with dirt or oil.

NG ▶ REPLACE AIR FILTER

OK

▼

5.	CHECK IDLING SPEED

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NG ▶ TROUBLESHOOT IDLING SPEED AND PROCEED TO NEXT STEP

OK

▼

6.	CHECK FUEL PRESSURE

NG ▶ TROUBLESHOOT FUEL PRESSURE AND PROCEED TO NEXT STEP

OK

▼

7.	CHECK FOR SPARK

NG ▶ TROUBLESHOOT SPARK AND PROCEED TO NEXT STEP

OK ▶ INFO **PROCEED TO PROBLEM SYMPTOMS TABLE**

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CHECKING MONITOR STATUS

The purpose of the monitor result (mode 06) is to allow access to the results for on-board diagnostic monitoring tests of specific components/systems that are not continuously monitored. Examples are the catalyst, evaporative emission (EVAP) and thermostat.

The monitor result allows the OBD II scan tool to display the monitor status, test value, minimum test limit and maximum test limit. These data are displayed after the vehicle has been driven to run the monitor.

When the test value is not between the minimum test limit and maximum test limit, the ECM (PCM) interprets this as a malfunction. When the component is not malfunctioning, if the difference of the test value and test limit is very small, the component will malfunction in the near future.

Perform the following instruction to view the monitor status. Although these instruction reference the Toyota diagnostic tester, it can be checked using a generic OBD II scan tool. Refer to your scan tool operator's manual for specific procedures.

1. PERFORM MONITOR DRIVE PATTERN

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear DTCs INFO.

(e) Run the vehicle in accordance with the applicable drive pattern described in Readiness Monitor Drive Pattern INFO. Do not turn the power switch off.

NOTICE:

The test results will be lost if the power switch is turned off.

2. ACCESS MONITOR RESULT

(a) Enter the following menus: Powertrain / Engine and ECT / Monitor / Result. The monitor status appears after the component name.

- Pass: The component is functioning normally.
- Fail: The component is malfunctioning.

(b) Confirm that the component is either Pass or Fail.

(c) Select the component and press ENTER. The accuracy test value appears if the monitor status is either Pass or Fail.

3. CHECK COMPONENT STATUS

(a) Compare the test value with the minimum test limit (MIN LIMIT) and maximum test limit (MAX LIMIT).

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(b) If the test value is between the minimum test limit and maximum test limit, the component is functioning normally. If not, the component is malfunctioning. The test value is usually significantly higher or lower than the test limit. If the test value is on the borderline of the test limit, the component will malfunction in the near future.

HINT:

The monitor result might on rare occasions be PASS even if the malfunction indicator lamp (MIL) is illuminated. This indicates the system malfunctioned on a previous driving cycle. This might be caused by an intermittent problem.

4. MONITOR RESULT INFORMATION

If you use a generic scan tool, multiply the value by the scaling value listed below.

Advance Intake Side

Monitor ID	Test ID	Scaling	Unit	Description
$35	$81	Multiply by 0.01	Second	Forced movement of oil control valve time

Exhaust Gas Recirculation System

Monitor ID	Test ID	Scaling	Unit	Description
$31	$BD	Multiply by 0.01	kPa	Delta Manifold Absolute Pressure

Air Fuel Ratio Sensor (Sensor 1)

Monitor ID	Test ID	Scaling	Unit	Description
$01	$8E	Multiply by 0.001	V	Air fuel ratio sensor deterioration level
$01	$91	Multiply by 0.004	mA	Air fuel ratio sensor current

Heated Oxygen Sensor (Sensor 2)

Monitor ID	Test ID	Scaling	Unit	Description
$02	$07	Multiply by 0.001	V	Minimum sensor voltage
$02	$08	Multiply by 0.001	V	Maximum sensor voltage
$02	$8B	Multiply by 0.001	Seconds	0.35 - 0.2 V sensor switch time
$02	$8D	Multiply by 0.001	Seconds	Duration that sensor voltage drops to 0.2 V during fuel-cut
$02	$8F	Multiply by 0.0003	g	Maximum oxygen storage capacity

Catalyst

Monitor ID	Test ID	Scaling	Unit	Description
$21	$A9	Multiply by 0.0003	No dimension	Oxygen storage capacity of catalyst

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EVAP

Monitor ID	Test ID	Scaling	Unit	Description
$3D	$C9	Multiply by 0.001	kPa	Test value for small leak (P0456)
$3D	$CA	Multiply by 0.001	kPa	Test value for gross leak (P0455)
$3D	$CB	Multiply by 0.001	kPa	Test value for leak detection pump OFF stuck (P2401)
$3D	$CD	Multiply by 0.001	kPa	Test value for leak detection pump ON stuck (P2402)
$3D	$CE	Multiply by 0.001	kPa	Test value for vent valve OFF stuck (P2420)
$3D	$CF	Multiply by 0.001	kPa	Test value for vent valve ON stuck (P2419)
$3D	$D0	Multiply by 0.001	kPa	Test value for reference orifice low flow (P043E)
$3D	$D1	Multiply by 0.001	kPa	Test value for reference orifice high flow (P043F)
$3D	$D4	Multiply by 0.001	kPa	Test value for purge VSV close stuck (P0441)
$3D	$D5	Multiply by 0.001	kPa	Test value for purge VSV open stuck (P0441)
$3D	$D7	Multiply by 0.001	kPa	Test value for purge flow insufficient (P0441)

Misfire

Monitor ID	Test ID	Scaling	Unit	Description
$A1	$0B	Multiply by 1	Time	Total EWMA misfire count of all cylinders in last ten driving cycles EWMA: Exponential Weighted Moving Average
$A1	$0C	Multiply by 1	Time	• When power switch on (IG), total misfire count of all cylinders in last driving cycle is displayed. • While engine is running, total misfire count of all cylinders in current driving cycle is displayed.
$A2	$0B	Multiply by 1	Time	Total EWMA misfire count of cylinder 1 in last ten driving cycles
$A2	$0C	Multiply by 1	Time	• When power switch on (IG), total misfire count of cylinder 1 in last driving cycle is displayed. • While engine is running, total misfire count of cylinder 1 in current driving cycle is displayed.
$A3	$0B	Multiply by 1	Time	Total EWMA misfire count of cylinder 2 in last ten driving cycles
$A3	$0C	Multiply by 1	Time	• When power switch on (IG), total misfire count of cylinder 2 in last driving cycle is displayed. • While engine is running, total misfire count of cylinder 2 in current driving cycle is displayed.
$A4	$0B	Multiply by 1	Time	Total EWMA misfire count of cylinder 3 in last ten driving cycles
$A4	$0C	Multiply	Time	• When power switch on (IG), total misfire count of cylinder 3 in

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Monitor ID	Test ID	Scaling	Unit	Description
		by 1		last driving cycle is displayed. • While engine is running, total misfire count of cylinder 3 in current driving cycle is displayed.
$A5	$0B	Multiply by 1	Time	Total EWMA misfire count of cylinder 4 in last ten driving cycles
$A5	$0C	Multiply by 1	Time	• When power switch on (IG), total misfire count of cylinder 4 in last driving cycle is displayed. • While engine is running, total misfire count of cylinder 4 in current driving cycle is displayed.

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READINESS MONITOR DRIVE PATTERN

1. PURPOSE OF READINESS TESTS

- The On-Board Diagnostic (OBD II) system is designed to monitor the performance of emission related components, and indicate any detected abnormalities using DTCs (Diagnostic Trouble Codes). Since various components need to be monitored during different driving conditions, the OBD II system is designed to run separate monitoring programs called Readiness Monitors.
- To view the status, enter the following menus: Powertrain / Engine and ECT / Monitor / Status2.
- When the status of a Readiness Monitor reads Complete, the necessary conditions have been met for running the performance tests for that Readiness Monitor.
- A generic OBD II scan tool can also be used to view the Readiness Monitor status.

HINT:

Many state Inspection and Maintenance (I/M) programs require the status of vehicle Readiness Monitors to show Complete before beginning emission tests.

- The Readiness Monitors will be reset to Incomplete if:

  - The ECM has lost battery power or blown a fuse.
  - DTCs have been cleared.
  - The conditions for running the Readiness Monitor have not been met.

- If a Readiness Monitor status shows Incomplete, follow the appropriate Readiness Monitor Drive Pattern to change the status to Complete.

CAUTION:

Strictly observe posted speed limits, traffic laws, and road conditions when performing these drive patterns.

NOTICE:

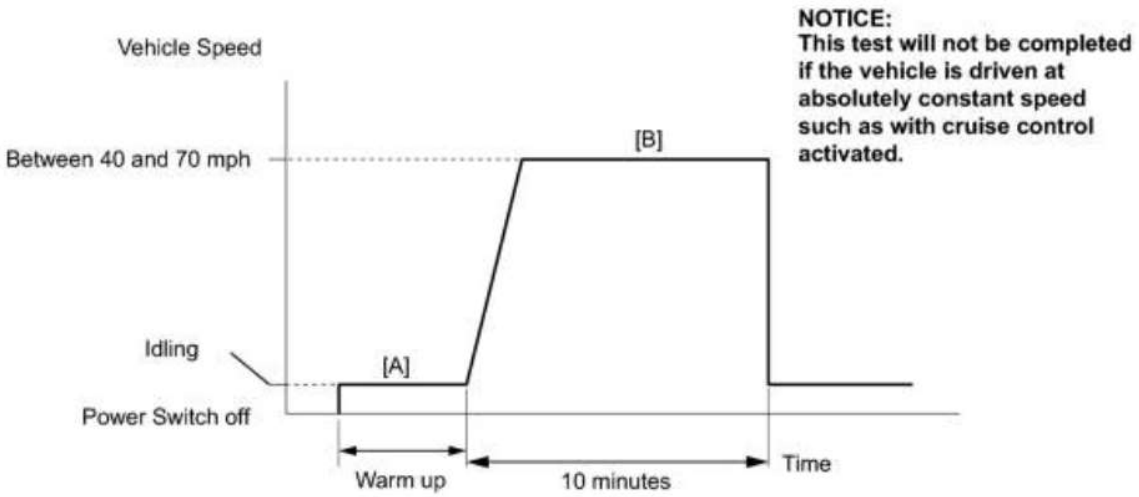
These drive patterns represent the fastest method of satisfying all conditions necessary to achieve complete status for each specific Readiness Monitor.

In the event of a drive pattern being interrupted (possibly due to factors such as traffic conditions), the drive pattern can be resumed. In most cases, the Readiness Monitor will still achieve complete status upon completion of the drive pattern.

To ensure completion of the Readiness Monitors, avoid sudden changes in vehicle load and speed (driving up and down hills and/or sudden acceleration).

2. CATALYST MONITOR (ACTIVE AIR FUEL RATIO CONTROL TYPE)

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(Note: Even when vehicle stops during drive pattern, test can be resumed.)

(a) Preconditions

- The monitor will not run unless:
  - The MIL is OFF.

(b) Drive Pattern

(1) Connect the Techstream to the DLC3.

(2) Turn the power switch on (IG).

(3) Turn the Techstream on.

(4) Clear DTCs (if set) INFO.

(5) Put the engine in inspection mode INFO.

(6) Start the engine and warm it up [A].

(7) Drive the vehicle at between 40 mph and 70 mph (64 km/h and 113 km/h) for at least 10 minutes [B].

(c) Monitor Status

Check the Readiness Monitor status displayed on the Techstream.

If the status does not switch to Complete, extend the driving time.

3. EVAP SYSTEM MONITOR (KEY OFF TYPE)

(a) Preconditions

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- The monitor will not run unless:
  - The fuel tank is less than 90% full.
  - The altitude is less than 8000 ft. (2438 m).
  - The vehicle is stationary.
  - The engine coolant temperature is between 4.4°C and 35°C (40°F and 95°F).
  - The intake air temperature is between 4.4°C and 35°C (40°F and 95°F).
  - The vehicle was driven in a city area (or on a free-way) for 10 minutes or more.

(b) Monitor Conditions

(1) Turn the power switch off and wait for 5 to 10 hours.

HINT:

Do not start the engine until checking Readiness Monitor status. If the engine is started, the step described above must be repeated.

(c) Monitor Status

(1) Connect the Techstream to the DLC3.

(2) Turn the power switch on (IG).

(3) Turn the Techstream on.

(4) Check the Readiness Monitor status displayed on the Techstream.

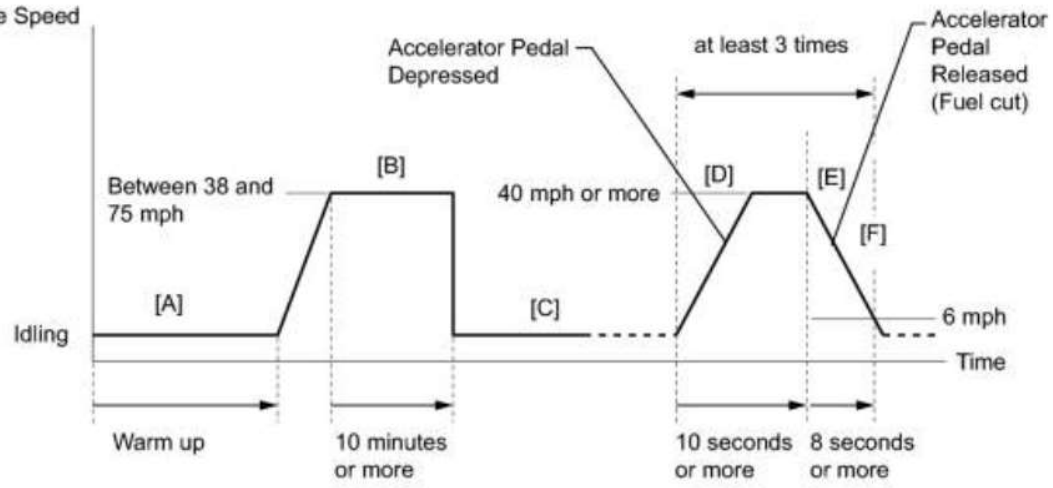
- If the status does not switch to Complete, restart the engine, make sure that the preconditions have been met, and then perform the Monitor Conditions again.

4. AIR FUEL RATIO AND HEATED OXYGEN SENSOR MONITORS (ACTIVE AIR FUEL RATIO CONTROL TYPE)

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Monitor Drive Pattern

Engine Coolant Temperature: 75°C or more



P

(a) Preconditions

- The monitor will not run unless:
  - 2 minutes or more have elapsed since the engine was started.
  - The engine coolant temperature is 75°C (167°F) or more.
  - Cumulative driving time at a vehicle speed of 30 mph (48 km/h) or more exceeds 6 minutes.
  - Air fuel ratio feedback control is performed.

(b) Drive Pattern for front air fuel ratio sensor and heated oxygen sensor

(1) Connect the Techstream to the DLC3.

(2) Turn the power switch on (IG).

(3) Turn the Techstream on.

(4) Clear DTCs INFO.

(5) Put the engine in inspection mode INFO.

(6) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) [A].

(7) Drive the vehicle at between 38 mph (60 km/h) and 75 mph (120 km/h) for at least 10 minutes [B].

(8) Move the shift lever to B [C].

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(9) Accelerate the vehicle to 40 mph (64 km/h) or more by depressing the accelerator pedal for at least 10 seconds [D].

(10) Soon after performing step [D] above, release the accelerator pedal for at least 8 seconds without depressing the brake pedal, in order to execute fuel-cut control [E].

(11) Allow the vehicle to decelerate until the vehicle speed declines to less than 6 mph (10 km/h) [F].

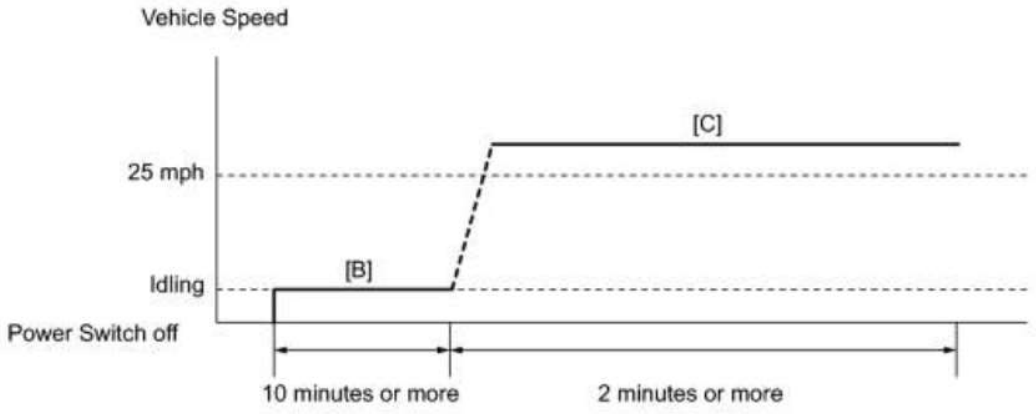
(12) Repeat steps from [D] through [F] above at least 3 times in one driving cycle [G].

(c) Monitor Status

(1) Check the Readiness Monitor status displayed on the Techstream.

(2) If the status does not switch to Complete, make sure that the preconditions have been met, and then perform steps from [A] through [G] in Drive Pattern above.

5. AIR FUEL RATIO AND HEATED OXYGEN SENSOR HEATER MONITORS (FRONT AIR FUEL RATIO AND REAR HEATED OXYGEN SENSOR TYPE)



Y

(a) Preconditions

- The monitor will not run unless:
  - The MIL is OFF.

(b) Drive Pattern

(1) Connect the Techstream to the DLC3.

(2) Turn the power switch on (IG).

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(3) Turn the Techstream on.

(4) Clear DTCs (if set) INFO.

(5) Put the engine in inspection mode INFO.

(6) Start the engine [A].

(7) Allow the engine to idle for 10 minutes or more [B].

(8) Drive the vehicle at 25 mph (40 km/h) or more for at least 2 minutes [C].

(c) Monitor Status

(1) Check the Readiness Monitor status displayed on the Techstream.

If the status does not switch to Complete, make sure that the preconditions have been met, and repeat steps [A] to [C] described in the Drive Pattern above.

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PROBLEM SYMPTOMS TABLE

HINT:

- Use the table below to help determine the cause of problem symptoms. If multiple suspected areas are listed, the potential causes of the symptoms are listed in order of probability in the "Suspected Area" column of the table. Check each symptom by checking the suspected areas in the order they are listed. Replace parts as necessary.
- Inspect the fuses and relays related to this system before inspecting the suspected areas below.

SFI System

Symptom	Suspected Area	See page
Engine does not crank (Does not start)	Engine immobiliser system	INFO
	Hybrid control system	INFO
	VC output circuit	INFO
	Smart key system	INFO
No initial combustion (Does not start)	ECM power source circuit	INFO
	VC output circuit	INFO
	Crankshaft position sensor	INFO
	Fuel pump control circuit	INFO
	Ignition system	INFO
	Fuel injector circuit	INFO
	Valve timing	INFO
Engine cranks normally but difficult to start	Fuel pump control circuit	INFO
	Fuel pump	INFO
	Engine coolant temperature sensor	INFO
	Ignition system	INFO
	Fuel injector assembly	INFO
	EGR valve assembly	INFO
	Compression	INFO
	Fuel injector circuit	INFO
	Intake system	INFO
	Throttle body assembly	INFO
	EGR valve assembly	INFO
Incomplete intermittent combustion occurs (Does not start)	Fuel pump control circuit	INFO
	Fuel pump	INFO
	Fuel line	-
	Ignition system	INFO
	Fuel injector assembly	INFO
	EGR valve assembly	INFO

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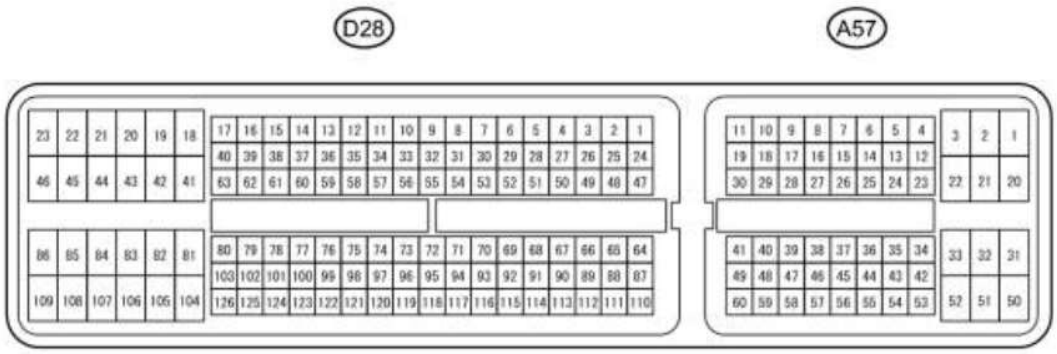
Symptom	Suspected Area	See page
	Crankshaft position sensor	INFO
	Valve timing	INFO
High engine idle speed	Throttle body assembly	INFO
	Intake system	INFO
	Engine coolant temperature sensor	INFO
	PCV system	INFO
	ECM power source circuit	INFO
Low engine idle speed (Poor idle)	Fuel pump control circuit	INFO
	Throttle body assembly	INFO
	Intake system	INFO
	PCV system	INFO
Engine stalls on deceleration	Idle speed (refer to "Low engine speed")	INFO
	EGR valve assembly	INFO
Rough idle	Compression	INFO
	Air fuel ratio sensor	INFO
	Heated oxygen sensor	INFO
	Mass air flow meter sub-assembly	INFO
	Manifold absolute pressure sensor	INFO
	Ignition system	INFO
	Fuel line	-
	Valve timing	INFO
	Fuel pump	INFO
	Intake system	INFO
	PCV system	INFO
	EGR valve assembly	INFO
Hunting	PCV system	INFO
	Air fuel ratio sensor	INFO
	Mass air flow meter sub-assembly	INFO
Hesitation/Poor acceleration	Fuel line	-
	Fuel pump	INFO
	Valve timing	INFO
	Mass air flow meter sub-assembly	INFO
	Throttle body assembly	INFO
	Knock control sensor	INFO
Surging (Poor driveability)	Fuel line	-
	Fuel pump control circuit	INFO
	Fuel pump	INFO
	Ignition system	INFO

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Symptom	Suspected Area	See page
	Fuel injector assembly	INFO
Engine stalls soon after starting	Mass air flow meter sub-assembly	INFO
	Intake system	INFO
	Manifold absolute pressure sensor	INFO
	Fuel line	-
	Valve timing	INFO
	EGR valve assembly	INFO
Engine coolant temperature indicator light illuminate	Engine coolant leaks	INFO
	Water pump assembly	INFO
Unable/difficult to refuel	Canister	INFO

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TERMINALS OF ECM



HINT:

The standard normal voltage between each pair of the ECM terminals is shown in the table below. The appropriate conditions for checking each pair of the terminals are also indicated. The result of checks should be compared with the standard normal voltage for that pair of the terminals, and displayed in the "Specified Condition" column. The illustration above can be used as a reference to identify the ECM terminal locations.

Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
A57-20 (BATT) - D28-104 (E1)	R - BR	Battery (for measuring battery voltage and for ECM memory)	Always	11 to 14 V
A57-2 (+B) - D28-104 (E1)	B - BR	Power source of ECM	Power switch on (IG)	11 to 14 V
A57-1 (+B2) - D28-104 (E1)	B - BR	Power source of ECM	Power switch on (IG)	11 to 14 V
A57-3 (+BM) - D28-104 (E1)	GR - BR	Power source of throttle actuator	Always	11 to 14 V
D28-108 (IGT1) - D28-104 (E1)	GR - BR	Ignition coil assembly (ignition signal)	Idling	Pulse generation (see waveform 1)
D28-107 (IGT2) - D28-104 (E1)	W - BR			
D28-106 (IGT3) - D28-104 (E1)	G - BR			
D28-105 (IGT4) - D28-104 (E1)	Y - BR			
D28-23 (IGF) - D28-104 (E1)	L - BR	Ignition coil assembly (ignition confirmation signal)	Power switch on (IG)	4.5 to 5.5 V
			Idling	Pulse generation

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Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
				(see waveform 1)
D28-74 (NE+) - D28-120 (NE-)	B - W	Crankshaft position sensor	Idling with warm engine	Pulse generation (see waveform 2)
D28-76 (G2+) - D28-122 (G2-)	B - W	Camshaft position sensor	Idling with warm engine	Pulse generation (see waveform 2)
D28-85 (#10) - D28-109 (E01)	Y - BR	Fuel injector assembly	Power switch on (IG)	11 to 14 V
D28-84 (#20) - D28-109 (E01)	B - BR			
D28-83 (#30) - D28-109 (E01)	L - BR		Idling	Pulse generation (see waveform 3)
D28-82 (#40) - D28-109 (E01)	R - BR			
D28-18 (HA1A) - D28-46 (E04)	Y - W-B	Air fuel ratio sensor (sensor 1) heater	Power switch on (IG)	11 to 14 V
			Idling with warm engine	Pulse generation (see waveform 4)
D28-103 (A1A+) - D28-104 (E1)	Y - BR	Air fuel ratio sensor (sensor 1)	Idling	3.3 V*1
D28-126 (A1A-) - D28-104 (E1)	BR - BR	Air fuel ratio sensor (sensor 1)	Idling	3.0 V*1
D28-41 (HT1B) - D28-86 (E03)	BR - BR	Heated oxygen sensor (sensor 2) heater	Power switch on (IG)	11 to 14 V
			Idling	Below 3.0 V
D28-125 (OX1B) - D28-102 (O1B-)	L - P	Heated oxygen sensor (sensor 2)	Engine speed maintained at 2500 rpm for 2 minutes after warming up engine	Pulse generation (see waveform 5)
D28-87 (KNK1) - D28-110 (EKNK)	B - W	Knock control sensor	Engine speed maintained at 4000 rpm after warming up engine	Pulse generation (see waveform 6)
D28-64 (THW) -	P - BR	Engine coolant temperature	Idling, Engine coolant	0.2 to 1.0 V

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Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
D28-65 (ETHW)		sensor	temperature 80°C (176°F)	
D28-116 (THA) - D28-93 (ETHA)	P - BR	Intake air temperature sensor (built into mass air flow meter sub-assembly)	Idling, Intake air temperature 20°C (68°F)	0.5 to 3.4 V
D28-94 (VG) - D28-117 (E2G)	B - W	Mass air flow meter sub-assembly	Idling, shift lever in N, A/C switch OFF	0.5 to 3.0 V
A57-36 (W) - D28-104 (E1)	LG - BR	MIL	Power switch on (IG) (MIL goes on)	Below 3.0 V
			Idling	11 to 14 V
D28-90 (VTA1) - D28-111 (ETA)	Y - G	Throttle position sensor (for engine control)	Power switch on (IG), Accelerator pedal released (Throttle valve fully closed)	0.5 to 1.1 V
D28-89 (VTA2) - D28-111 (ETA)	B - G	Throttle position sensor (for sensor malfunction detection)	Power switch on (IG), Accelerator pedal released (Throttle valve fully closed)	2.1 to 3.1 V
D28-88 (VCTA) - D28-111 (ETA)	R - G	Power source of sensor (specific voltage)	Power switch on (IG)	4.5 to 5.5 V
D28-21 (M+) - D28-19 (ME01)	L - BR	Throttle actuator	Idling with warm engine	Pulse generation (see waveform 7)
D28-20 (M-) - D28-19 (ME01)	P - BR	Throttle actuator	Idling with warm engine	Pulse generation (see waveform 8)
D28-28 (PRG) - D28-104 (E1)	V - BR	Purge VSV	Power switch on (IG)	11 to 14 V
			Idling, under purge control	Pulse generation (see waveform 9)
A57-8 (FC) - D28-104 (E1)	R - BR	Fuel pump control	Power switch on (IG)	11 to 14 V
			Idling	Below 1.5 V
A57-7 (TC) - D28-104 (E1)	P - BR	Terminal TC of DLC3	Power switch on (IG)	11 to 14 V
D28-36 (OC1+) - D28-59 (OC1-)	Y - G	Camshaft timing oil control valve assembly	Idling	Pulse generation (see

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Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
				waveform 10)
A57-13 (CANH) - D28-104 (E1)	P - BR	CAN communication line	Engine stopped and power switch on (IG)	Pulse generation (see waveform 11)
A57-5 (CANL) - D28-104 (E1)	V - BR	CAN communication line	Engine stopped and power switch on (IG)	Pulse generation (see waveform 12)
A57-12 (CANP) - D28-104 (E1)	B - BR	CAN communication line	Engine stopped and power switch on (IG)	Pulse generation (see waveform 11)
A57-4 (CANN) - D28-104 (E1)	W - BR	CAN communication line	Engine stopped and power switch on (IG)	Pulse generation (see waveform 12)
A57-28 (IGSW) - D28-104 (E1)	W - BR	Power switch	Power switch on (IG)	11 to 14 V
A57-6 (MREL) - D28-104 (E1)	G - BR	EFI MAIN relay	Power switch on (IG)	11 to 14 V
D28-99 (VCV1) - D28-104 (E1)	R - BR	Power source of camshaft position sensor	Power switch on (IG)	4.5 to 5.5 V
A57-10 (WPO) - D28-104 (E1)	L - BR	Water pump assembly	Idling with warm engine	Pulse generation (see waveform 13)
A57-11 (WPI) - D28-104 (E1)	G - BR	Water pump assembly	Idling with warm engine	Pulse generation (see waveform 14)
D28-72 (VCPM) - D28-71 (EPIM)	L - Y	Manifold absolute pressure sensor	Power switch on (IG)	4.5 to 5.5 V

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Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
D28-69 (PIM) - D28-71 (EPIM)	B - Y	Manifold absolute pressure sensor	Power switch on (IG)	4.0 to 5.5 V
D28-45 (EGR1) - D28-104 (E1)	R - BR	EGR valve assembly	Idling with warm engine	Pulse generation (see waveform 15)
D28-44 (EGR2) - D28-104 (E1)	V - BR	EGR valve assembly	Idling with warm engine	Pulse generation (see waveform 15)
D28-43 (EGR3) - D28-104 (E1)	Y - BR	EGR valve assembly	Idling with warm engine	Pulse generation (see waveform 15)
D28-42 (EGR4) - D28-104 (E1)	LG - BR	EGR valve assembly	Idling with warm engine	Pulse generation (see waveform 15)
D28-48 (G2O) - D28-104 (E1)	Y - BR	Camshaft position signal	Idling	Pulse generation (see waveform 16)
A57-22 (FANH) - D28-104 (E1)	LG - BR	Cooling fan relay	Power switch on (IG)	11 to 14 V
A57-21 (FANL) - D28-104 (E1)	L - BR	Cooling fan relay	Power switch on (IG)	11 to 14 V
A57-46 (PWMS) - D28-104 (E1)	G - BR	Power mode switch	Power switch on (IG), Power mode switch off	11 to 14 V
			Power switch on (IG), Power mode switch on	0 to 1.5 V
D28-104 (E1) - Body ground	BR - Body ground	Ground	Always	Below 1 Ω
D28-109 (E01) - Body ground	BR - Body ground	Ground	Always	Below 1 Ω
D28-81 (E02) -	W-B -	Ground	Always	Below 1 Ω

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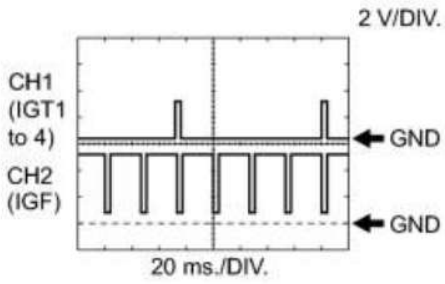
Terminal No. (Symbol)	Wiring Color	Terminal Description	Condition	Specified Condition
Body ground	Body ground			
D28-86 (E03) - Body ground	BR - Body ground	Ground	Always	Below 1 Ω
D28-46 (E04) - Body ground	BR - Body ground	Ground	Always	Below 1 Ω
A57-32 (EC) - Body ground	W-B - Body ground	Ground	Always	Below 1 Ω
D28-22 (GE01) - D28-104 (E1)	W-B - BR	Shield earth (ground) circuit of throttle actuator	Always	Below 1 V
A57-42 (VPMP) - D28-104 (E1)	B - BR	Vent valve (built into canister pump module)	Power switch on (IG)	11 to 14 V
A57-34 (MPMP) - D28-104 (E1)	L - BR	Leak detection pump (built into canister pump module)	Leak detection pump OFF	Below 3 V
			Leak detection pump ON	11 to 14 V
D28-113 (VCPP) - D28-112 (EPPM)	GR - LG	Power source for canister pressure sensor (specific voltage)	Power switch on (IG)	4.5 to 5.5 V
D28-114 (PPMP) - D28-112 (EPPM)	W - LG	Canister pressure sensor (built into canister pump module)	Power switch on (IG)	3 to 3.6 V

HINT:

*1: The ECM terminal voltage is constant regardless of the output voltage from the sensor.

1. WAVEFORM 1

Igniter IGT Signal (from ECM to Igniter) and Igniter IGF Signal (from Igniter to ECM)



ECM Terminal Name	Between IGT (1 to 4) and E1 Between IGF and E1
Tester Range	2 V/DIV., 20 ms./DIV.
Condition	Idling

HINT:

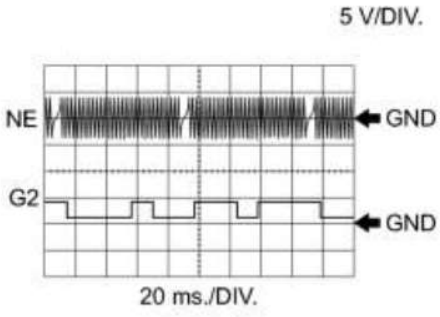
The wavelength becomes shorter as the engine speed increases.

2. WAVEFORM 2

Crankshaft Position Sensor and Camshaft

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Position Sensor Signal



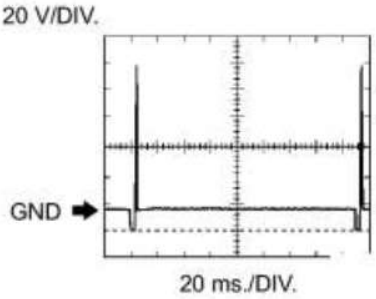
ECM Terminal Name	Between NE+ and NE- Between G2+ and G2-
Tester Range	5 V/DIV., 20 ms./DIV.
Condition	Idling with warm engine

HINT:

The wavelength becomes shorter as the engine speed increases.

3. WAVEFORM 3

No. 1 (to No. 4) Fuel Injector Assembly Signal



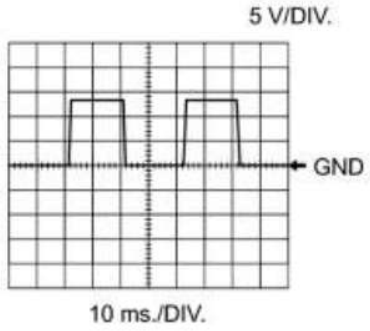
ECM Terminal Name	Between #10 (to #40) and E01
Tester Range	20 V/DIV., 20 ms./DIV.
Condition	Idling

HINT:

The wavelength becomes shorter as the engine speed increases.

4. WAVEFORM 4

Air Fuel Ratio Sensor (Sensor 1) Heater Signal



ECM Terminal Name	Between HA1A and E04
Tester Range	5 V/DIV., 10 ms./DIV.
Condition	Idling with warm engine

HINT:

Y

The wavelength varies in accordance with the engine operating condition.

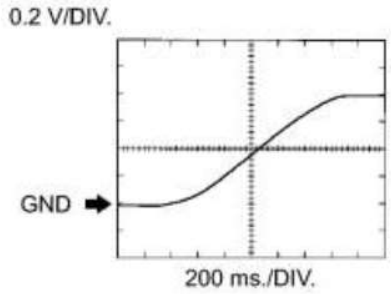
5. WAVEFORM 5

Heated Oxygen Sensor (Sensor 2) Signal

ECM Terminal Name	Between OX1B and O1B-
Tester Range	0.2 V/DIV. 200 ms./DIV.
Condition	Engine speed maintained at 2500 rpm for 2 minutes

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	after warming up engine

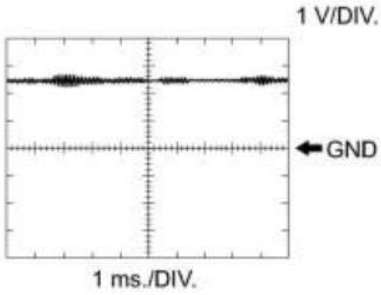


HINT:

In the Data List, the items O2S B1 S2 show the values input to the ECM from the heated oxygen sensor.

6. WAVEFORM 6

Knock Control Sensor Signal



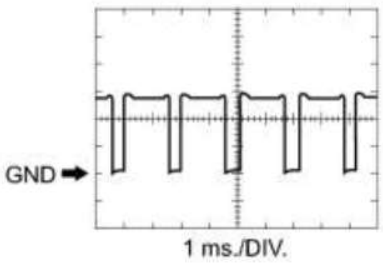
ECM Terminal Name	Between KNK1 and EKNK
Tester Range	1 V/DIV., 1 ms./DIV.
Condition	Engine speed maintained at 4000 rpm after engine warming engine

- The wavelength becomes shorter as the engine speed increases.
- The waveforms and amplitudes displayed differ slightly depending on the vehicle condition.

T

7. WAVEFORM 7

Throttle Actuator Positive Terminal Signal



ECM Terminal Name	Between M+ and ME01
Tester Range	5 V/DIV., 1 ms./DIV.
Condition	Idling with warm engine

HINT:

The duty ratio varies depending on the throttle actuator operation.

T

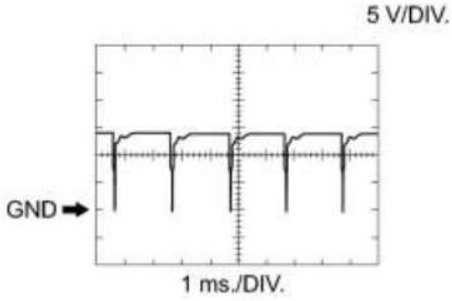
8. WAVEFORM 8

Throttle Actuator Negative Terminal Signal

ECM Terminal Name	Between M- and ME01
Tester Range	5 V/DIV., 1 ms./DIV.

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Condition	Idling with warm engine



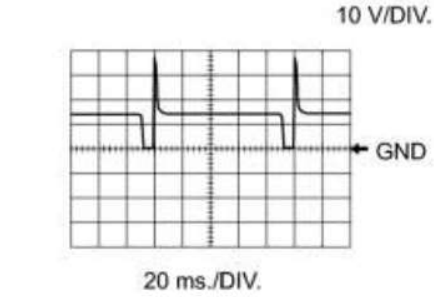
T

HINT:

The duty ratio varies depending on the throttle actuator operation.

9. WAVEFORM 9

Purge VSV



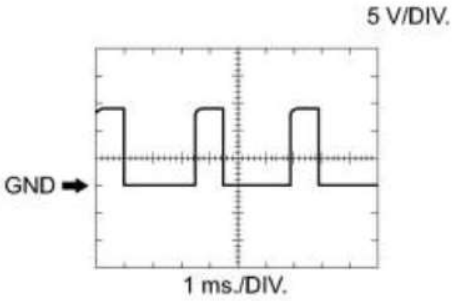
Y

ECM Terminal Name	Between PRG and E1
Tester Range	10 V/DIV., 20 ms./DIV.
Condition	Idling, under purge control

HINT:

If the waveform is not similar to the illustration, check the waveform again after idling for 10 minutes or more.

10. WAVEFORM 10



Camshaft Timing Oil Control Valve Assembly Signal

T

ECM Terminal Name	Between OC1+ and OC1-
Tester Range	5 V/DIV., 1 ms./DIV.
Condition	Idling

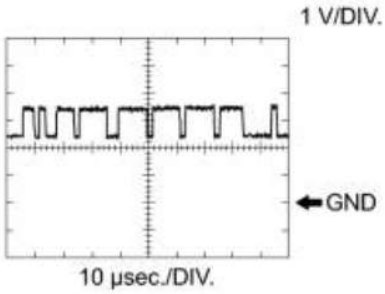
11. WAVEFORM 11

CAN Communication Signal (Reference)

ECM Terminal Name	Between CANH and E1, CANP and E1
Tester Range	1 V/DIV., 10 μsec./DIV.
Condition	Engine stopped and power switch on (IG)

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HINT:

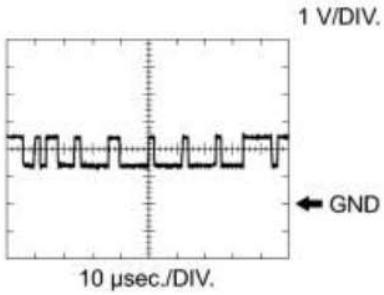


The waveform varies depending on the CAN communication signal.

T

12. WAVEFORM 12

CAN Communication Signal (Reference)



ECM Terminal Name	Between CANL and E1, CANN and E1
Tester Range	1 V/DIV., 10 µsec./DIV.
Condition	Engine stopped and power switch on (IG)

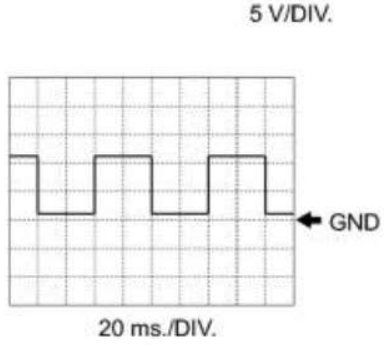
HINT:

The waveform varies depending on the CAN communication signal.

T

13. WAVEFORM 13

Water Pump Assembly Signal (from ECM to Water Pump Assembly)



ECM Terminal Name	Between WPO and E1
Tester Range	5 V/DIV., 20 ms./DIV.
Condition	Idling with warm engine

HINT:

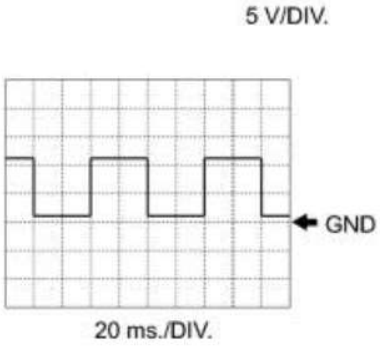
The wavelength becomes shorter as the water pump speed increases.

14. WAVEFORM 14

Water Pump Assembly Signal (from Water Pump Assembly to ECM)

ECM Terminal Name	Between WPI and E1
Tester Range	5 V/DIV., 20 ms./DIV.

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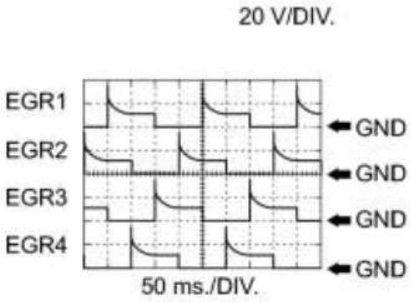


Condition	Idling with warm engine

HINT:

The wavelength becomes shorter as the water pump speed increases.

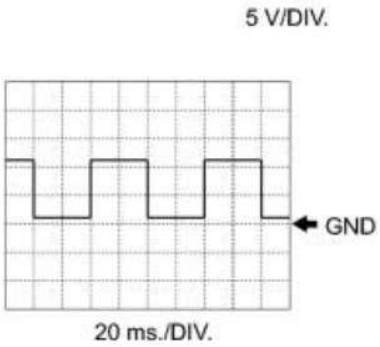
15. WAVEFORM 15



EGR Valve Assembly Signal

ECM Terminal Name	Between EGR1 and E1, EGR2 and E1, EGR3 and E1, EGR4 and E1
Tester Range	20 V/DIV., 50 ms./DIV.
Condition	Idling with warm engine

16. WAVEFORM 16



Camshaft Revolution Signal from ECM to Power Management Control ECU and Inverter with Converter Assembly (MG ECU)

ECM Terminal Name	Between G2O and E1
Tester Range	5 V/DIV., 20 ms./DIV.
Condition	Idling

HINT:

The wavelength becomes shorter as the engine speed increases.

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DIAGNOSIS SYSTEM

1. DESCRIPTION

- When troubleshooting OBD II (On-Board Diagnostics) vehicles, an OBD II scan tool (complying with SAE J1987) must be connected to the DLC3 (Data Link Connector 3) of the vehicle. Various data in the vehicle ECM (Engine Control Module) can be then read.
- OBD II regulations require that the vehicle on-board computer illuminates the MIL (Malfunction Indicator Lamp) on the instrument panel when the computer detects a malfunction in:



a. The emission control system and components.
b. The powertrain control components (which affect vehicle emissions).
c. The computer itself.

- In addition, the applicable DTCs prescribed by SAE J2012 are recorded in the ECM memory. If the malfunction does not recur in 3 consecutive trips, the MIL turns off automatically but the DTCs remain recorded in the ECM memory.
- To check the DTCs, connect the Techstream to the DLC3. The Techstream displays DTCs, freeze frame data, and a variety of the engine data. The DTCs and freeze frame data can be cleared with the Techstream. In order to enhance OBD function on vehicles and develop the Off-Board diagnosis system, Controller Area Network (CAN) communication is used in this system. CAN is a network which uses a pair of data transmission lines spanning multiple computers and sensors. It allows for high speed communications between the systems and simplification of the wire harness connections.

2. NORMAL MODE AND CHECK MODE

The diagnosis system operates in normal mode during normal vehicle use. In normal mode, 2 trip detection logic is used to ensure accurate detection of malfunctions. Check mode is also available as an option for technicians. In check mode, 1 trip detection logic is used for simulating malfunction symptoms and increasing the system's ability to detect malfunctions, including intermittent problems (the Techstream only).

3. 2 TRIP DETECTION LOGIC

- When a malfunction is first detected, the malfunction is temporarily stored in the ECM memory (1st trip). If the same malfunction is detected during the subsequent drive cycle, the MIL is illuminated (2nd trip).

4. DLC3 (Data Link Connector 3)

(a) Check DLC3 INFO.

5. FREEZE FRAME DATA

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- The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

6. BATTERY VOLTAGE

Standard voltage:

11 to 14 V

- If voltage is below 11 V, replace or recharge the battery.

7. MIL (Malfunction Indicator Lamp)

(a) The MIL illuminates when the power switch is first turned on (IG) (the engine is not running).

(b) The MIL should turn off when the engine is started. If the MIL remains illuminated, the diagnosis system has detected a malfunction or abnormality in the system.

HINT:

If the MIL does not illuminate when the power switch is first turned on (IG), check the MIL circuit INFO.

8. ALL READINESS

HINT:

- With "ALL READINESS", you can check whether or not the DTC judgment has been completed by using the Techstream.
- You should check "ALL READINESS" after simulating malfunction symptoms or for validation after finishing repairs.

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear DTCs INFO.

(e) Turn the power switch off and wait for 30 seconds.

(f) Turn the power switch on (IG) and turn the Techstream on.

(g) Perform the DTC judgment driving pattern to run the DTC judgment.

(h) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(i) Input the DTCs to be confirmed.

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(j) Check the DTC judgment result.

Techstream

Techstream Display	Description
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform the driving pattern after confirming the DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

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DTC CHECK / CLEAR

NOTICE:

When the diagnosis system is changed from normal mode to check mode or vice versa, all DTCs and freeze frame data recorded in normal mode are cleared. Before changing modes, always check and make a note of DTCs and freeze frame data.

HINT:

- DTCs which are stored in the ECM can be displayed on the Techstream. The Techstream can display the current, pending and permanent DTCs.
- If a malfunction is detected during the current driving cycle, current and permanent DTCs are stored.
- Some DTCs are not stored if the ECM does not detect the same malfunction again during a second consecutive driving cycle. However, such malfunctions, detected on only one occasion, are stored as pending DTCs.
- Current and pending DTCs can be cleared by using the Techstream or by disconnecting the cable from the negative battery terminal. However, permanent DTCs cannot be cleared using either of these two methods.
- After clearing current DTCs using the Techstream (or by disconnecting the cable from the negative battery terminal), permanent DTCs can be cleared when the system is determined to be normal for the relevant DTCs and then the universal trip is performed. The driving pattern to obtain a normal judgment is described under the "Confirmation Driving Pattern" for the respective DTC.

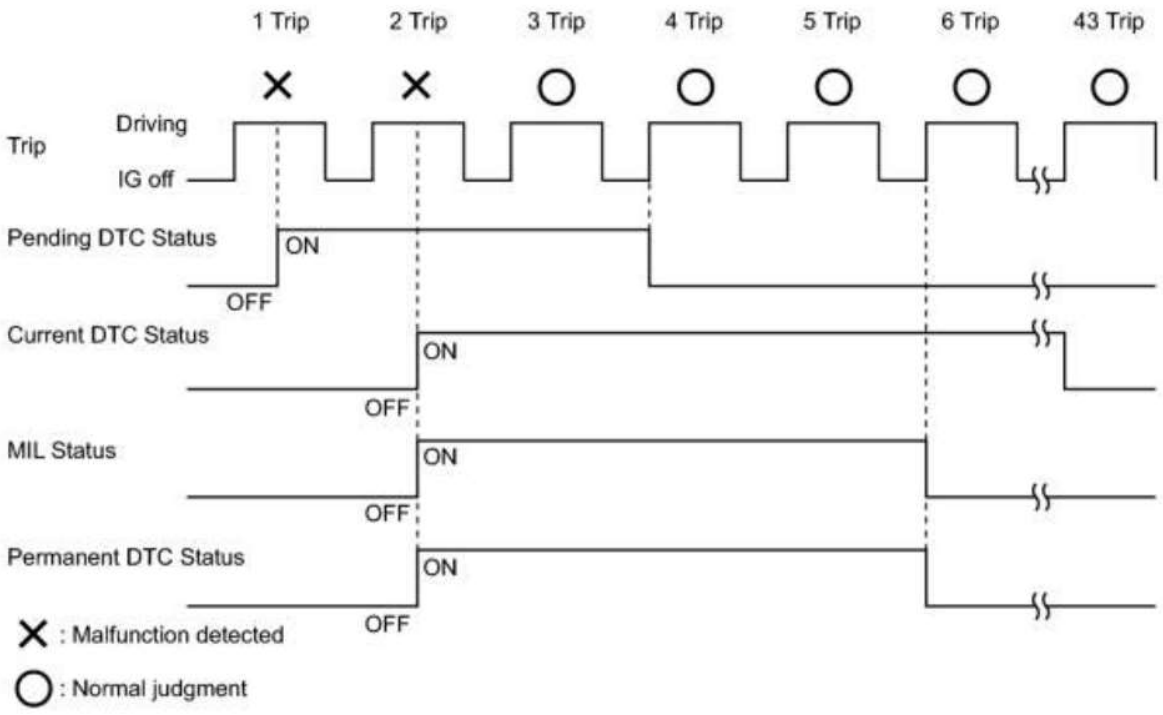
2 Trip Detection Examples

Pending DTC	Store condition	Malfunction detected
	Clear condition	System determined to be normal or DTCs cleared using Techstream or Cable disconnected from negative (-) battery terminal
Current DTC	Store condition	Malfunction detected (2nd trip)
	Clear condition	No malfunctions in 40 driving cycles or DTCs cleared using Techstream or Cable disconnected from negative (-) battery terminal
Permanent	Store	Malfunction detected (2nd trip)

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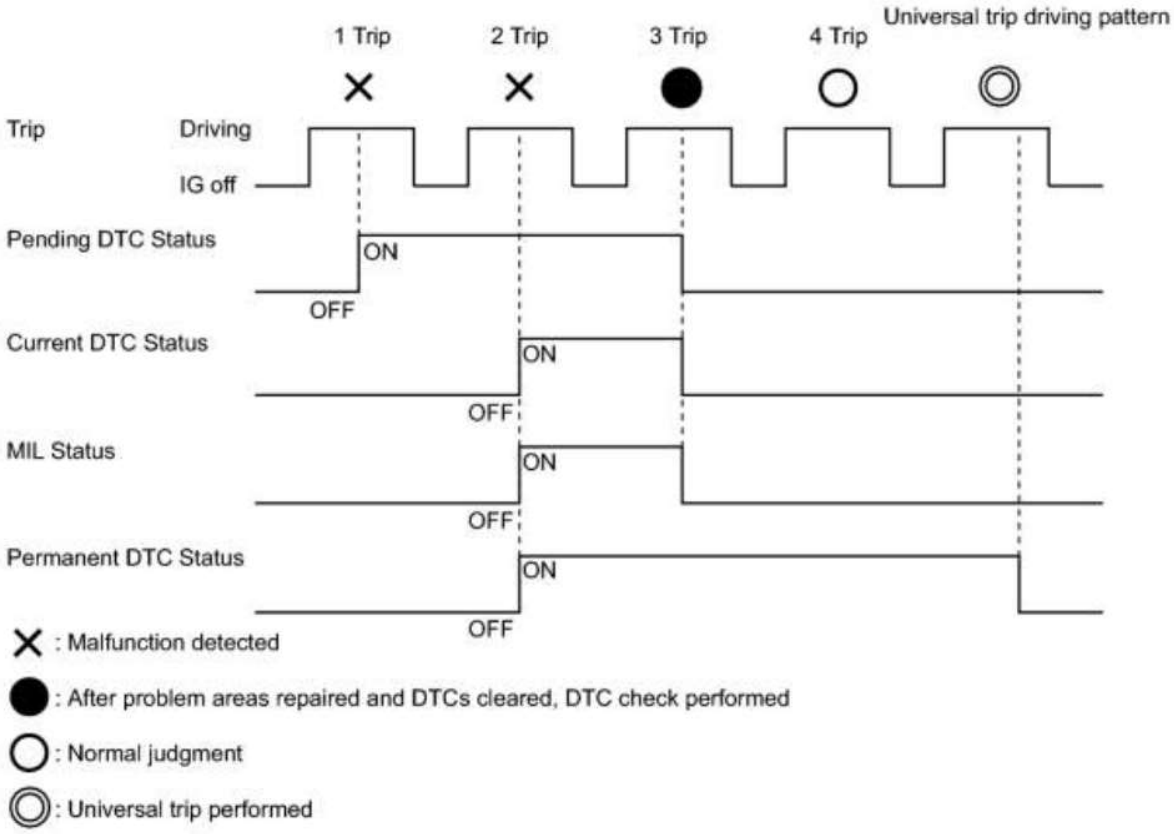
DTC	condition	
	Clear condition	Power switch turned to on (IG) after normal judgment obtained in 3 consecutive driving cycles or After DTCs cleared using Techstream or cable disconnected from negative (-) battery terminal, normal judgment obtained and universal trip performed (not for misfire and fuel system DTCs) or After DTCs cleared using Techstream or cable disconnected from negative (-) battery terminal, malfunction not detected when universal trip driving performed (misfire and fuel system DTCs)
MIL	ON	Malfunction detected (2nd trip)
	OFF	Power switch turned to on (IG) after normal judgment obtained in 3 consecutive driving cycles or DTCs cleared using Techstream or Cable disconnected from negative (-) battery terminal

2 Trip Detection Examples



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2 Trip Detection Examples (Instance when DTCs were cleared midway through by using the Techstream or by disconnecting the cable from the negative battery terminal)



HINT:

- Obtaining a normal judgment and performing a universal trip driving pattern can be done in the same driving cycle or in different driving cycles.
- It is unnecessary to obtain a normal judgment if the DTCs are misfire or fuel system DTCs.

1. CHECK DTC

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Check the DTC(s) and freeze frame data, and then write them down.

(f) Check the details of the DTC(s) INFO.

2. CLEAR DTC (Pending and Current DTC)

(a) Connect the Techstream to the DLC3.

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(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Clear the DTCs.

3. CLEAR DTC (Pending and Current DTC without using Techstream)

(a) Perform either of the following operations:

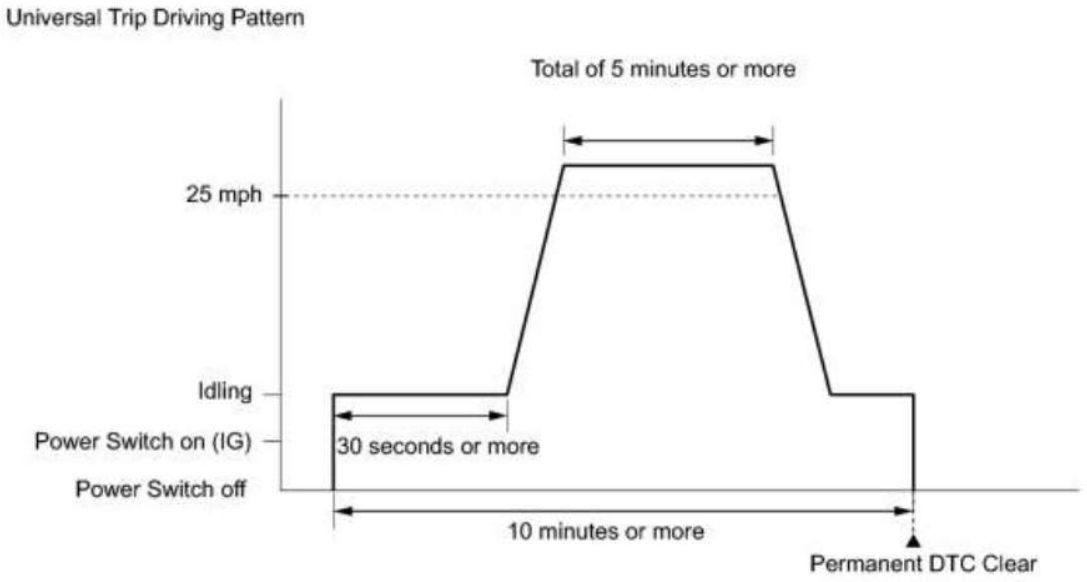
(1) Disconnect the cable from the negative (-) battery terminal for more than 1 minute.

(2) Remove the EFI MAIN and ETCS fuses from the engine room relay block located inside the engine compartment for more than 1 minute.

4. CLEAR PERMANENT DTC

HINT:

Even if the following procedure is not performed, permanent DTCs are cleared by obtaining a normal judgment during 3 consecutive driving cycles.



(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

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(e) Check if permanent DTCs are stored.

HINT:

If permanent DTCs are not output, it is not necessary to continue this procedure.

(f) Clear DTCs.

(g) Perform the respective confirmation driving patterns in order to obtain a normal judgment for the output DTCs.

HINT:

- Confirmation driving patterns do not need to be performed for misfire and fuel system DTCs.
- For the confirmation driving pattern, refer to the procedures for the relevant DTC INFO.

(h) Perform the universal trip.

HINT:

The driving pattern to obtain a normal judgment and the universal trip driving can be performed consecutively in the same driving cycle.

1. Put the engine in inspection mode INFO.
2. Idle the engine for 30 seconds or more.
3. Drive the vehicle at 25 mph (40 km/h) or more for a total of 5 minutes or more.

   HINT:

   It is possible to complete the drive pattern even if the vehicle decelerates to less than 25 mph (40 km/h) during the driving cycle provided that the vehicle is driven at 25 mph (40 km/h) or more for a total of 5 minutes.

4. Allow 10 minutes or more to elapse from the time the engine is started.

(i) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(j) Check that the permanent DTCs have been cleared.

HINT:

The permanent DTCs are cleared when the universal trip is completed.

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FREEZE FRAME DATA

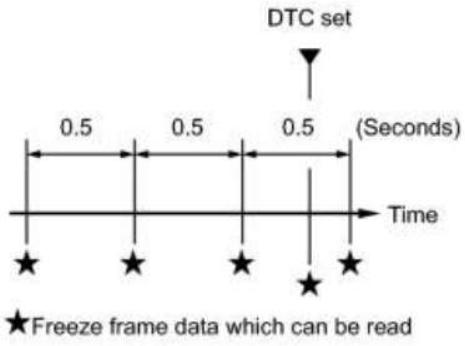
1. DESCRIPTION

• The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was moving or stationary, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

HINT:

If it is impossible to replicate the problem even though a DTC is detected, confirm the freeze frame data.

• The ECM records engine conditions in the form of freeze frame data every 0.5 seconds. Using the Techstream, five separate sets of freeze frame data, including the data values at the time when the DTC was set, can be checked.



- 3 data sets before the DTC was set.
- 1 data set when the DTC was set.
- 1 data set after the DTC was set.

2. LIST OF FREEZE FRAME DATA

Tester Display	Measurement Item	Diagnostic Note
Vehicle Speed	Vehicle speed	Speed indicated on speedometer
Engine Speed	Engine speed	-
Calculate Load	Calculated load by ECM	-
Vehicle Load	Vehicle load	Load percentage in terms of maximum intake air flow amount
MAF	Air flow rate from mass air flow meter sub-assembly	If value approximately 0.0 gm/sec: • Mass air flow meter sub-assembly power source circuit open • VG circuit open or short

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Tester Display	Measurement Item	Diagnostic Note
		If value 271.0 gm/sec or more: • E2G circuit open
Atmosphere Pressure	Atmosphere pressure	-
MAP	Intake manifold pressure	-
Coolant Temp	Engine coolant temperature	• If value -40°C (-40°F): sensor circuit open • If value 140°C (284°F): sensor circuit shorted
Intake Air	Intake air temperature	• If value -40°C (-40°F): sensor circuit open • If value 140°C (284°F): sensor circuit shorted
Engine Run Time	Engine run time	-
Initial Engine Coolant Temp	Initial engine coolant temperature	Service data
Initial Intake Air Temp	Initial intake air temperature	Service data
Battery Voltage	Battery voltage	-
Throttle Sensor Volt %	Throttle sensor positioning	Recognition value for throttle opening angle on ECM
Throttl Sensor #2 Volt %	Absolute throttle sensor positioning #2	Recognition value for throttle opening angle on ECM
Throttle Sensor Position	Throttle sensor positioning	Recognition value for throttle opening angle on ECM
Throttle Motor DUTY	Throttle actuator	-
Injector (Port)	Injection direction for cylinder 1	-
Injection Volum (Cylinder1)	Injection volume (Cylinder 1)	Quantity of fuel injection volume for 10 times
Fuel Pump/Speed Status	Fuel pump/status	Active Test support data
Vacuum Pump	Key-off EVAP system leak detection pump status	Active Test support data
EVAP (Purge) VSV	Purge VSV control duty ratio	Order signal from ECM
Evap Purge Flow	Ratio of evaporative purge flow to intake air volume	Service data
Purge Density Learn Value	Learning value of purge density	Service data

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Tester Display	Measurement Item	Diagnostic Note
EVAP System Vent Valve	Key-off EVAP system vent valve status	Active Test support data
EVAP Purge VSV	Purge VSV status for EVAP control	Active Test support data
Purge Cut VSV Duty	Purge cut vacuum switching valve duty ratio	-
Target Air-Fuel Ratio	Ratio compared to stoichiometric level	-
AF Lambda B1S1	Short-term fuel trim associated with bank 1 sensor 1	-
AFS Voltage B1S1	Air fuel ratio sensor output voltage for bank 1 sensor 1	Performing Control the Injection Volume or Control the Injection Volume for A/F Sensor function of Active Test enables technician to check output voltage of sensors
AFS Current B1S1	Air fuel ratio sensor output current for bank 1 sensor 1	Value becomes higher when fuel-cut executed under high engine speed
A/F Heater Duty #1	Air fuel ratio sensor heater duty ratio	-
O2S B1S2	Heated oxygen sensor output voltage for bank 1 sensor 2	Performing Control the Injection Volume or Control the Injection Volume for A/F Sensor function of Active Test enables technician to check output voltage of sensors
O2S Impedance B1S2	Heated oxygen sensor impedance (bank 1 sensor 2)	-
O2 Heater B1S2	Heated oxygen sensor operation	-
O2 Heater Curr Val B1S2	Heated oxygen sensor current	-
Short FT #1	Short-term fuel trim of bank 1	Short-term fuel compensation used to maintain air fuel ratio at stoichiometric air fuel ratio
Long FT #1	Long-term fuel trim of bank 1	Overall fuel compensation carried out in long-term to compensate continual deviation of short-term fuel trim from central value
Total FT #1	Total fuel trim	-
Fuel System Status #1	Fuel system status (bank 1)	• OL (Open Loop): Has not yet satisfied conditions to go closed loop • CL (Closed Loop): Using air fuel ratio sensor as feedback for fuel control • OLDrive: Open loop due to driving conditions (fuel enrichment) • OLFault: Open loop due to detected system fault • CLFault: Closed loop but air fuel ratio sensor, which

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Tester Display	Measurement Item	Diagnostic Note
		is used for fuel control, malfunctioning
Fuel System Status #2	Fuel system status (bank 2) (Unused)	• OL (Open Loop): Has not yet satisfied conditions to go closed loop • CL (Closed Loop): Using air fuel ratio sensor as feedback for fuel control • OLDrive: Open loop due to driving conditions (fuel enrichment) • OLFault: Open loop due to detected system fault • CLFault: Closed loop but air fuel ratio sensor, witch is used for fuel control, malfunctioning
IGN Advance	Ignition timing advance for cylinder 1	-
Knock Feedback Value	Feedback value of knocking	Service data
Knock Correct Learn Value	Correction learning value of knocking	Service data
Target EGR Position	Target EGR position	-
EGR Step Position	EGR step position	-
VVT Control Status #1	VVT control (bank 1) status	Active Test support data
Catalyst Temp B1S1	Catalyst temperature (associated sensor 1)	-
Catalyst Temp B1S2	Catalyst temperature (associated sensor 2)	-
Closed Throttle Position SW	Closed throttle position switch	-
Fuel Cut Condition	Fuel cut condition ON or OFF	-
TC Terminal	TC terminal status	-
Time after DTC Cleared	Time since DTCs cleared	-
Distance from DTC Cleared	Distance traveled since DTCs cleared	-
Warmup Cycle Cleard DTC	Warm-up cycles since DTCs cleared	Number of warm-up cycles since DTCs cleared
Dist Batt Cable Disconnect	Accumulated distance from battery cable disconnected	-

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Tester Display	Measurement Item	Diagnostic Note
IG OFF Elapsed Time	Cumulative time after power switch off	-
TC and TE1	TC and CG (TE1) terminals of DLC3	Active Test support data
Ignition Trig. Count	Ignition counter to calculated misfire count	-
Cylinder #1 Misfire Count	Misfire count for cylinder 1	-
Cylinder #2 Misfire Count	Misfire count for cylinder 2	-
Cylinder #3 Misfire Count	Misfire count for cylinder 3	-
Cylinder #4 Misfire Count	Misfire count for cylinder 4	-
All Cylinders Misfire Count	All cylinders misfire count	-
Misfire RPM	Average engine speed when misfire occurs	-
Misfire Load	Average engine load when misfire occurred	-
Electric Fan Motor	Electric cooling fan motor	Active Test support data
Idle Fuel Cut Prohibit	Prohibition of fuel cut at idle	-
Idle Fuel Cut	Fuel cut idle	ON: When throttle valve fully closed and engine speed over 2800 rpm
FC TAU	FC TAU	Fuel cut being performed under very light load to prevent engine combustion from becoming incomplete
Communication with HV	Status of the communication with power management control ECU	-
Communication with Brake	Status of the communication with skid control ECU	-
Comm with Air Conditioner	Status of the communication with air conditioning amplifier assembly	-
Requested Engine Torque	Requested engine torque	Flag information for hybrid vehicle
HV Target Engine Speed	HV target engine speed	Flag information for hybrid vehicle
Actual Engine Torque	Actual engine torque	Flag information for hybrid vehicle
Engine Run Time	Engine run time	Flag information for hybrid vehicle
Request Engine	Request engine run time	Flag information for hybrid vehicle

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Tester Display	Measurement Item	Diagnostic Note
Run Time		
Judge Time Engine Ignition	Judgment time for engine ignition	Flag information for hybrid vehicle
Judge Time Engine Output	Judgment time for time until engine output	Flag information for hybrid vehicle
ISC Learning	Idle speed control learning	Flag information for hybrid vehicle
F/C for Engine Stop Req	Fuel cut for engine stop request	Flag information for hybrid vehicle
Engine Independent	Engine independent operation	Flag information for hybrid vehicle
Racing Operation	Racing operation	Flag information for hybrid vehicle
Request Warm-up	Request engine warm up	Flag information for hybrid vehicle
Engine Independent Control	Engine independent control operation	Flag information for hybrid vehicle
Elec Water Pump Target Spd	Electronic water pump target speed	-
Elec Water Pump Spd	Electronic water pump speed	-
ISC Learning Value	Idle speed control leaning value	Flag information for hybrid vehicle

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CHECK MODE PROCEDURE

Compared to normal mode, check mode is more sensitive to malfunctions. Therefore, check mode can detect malfunctions that cannot be detected in normal mode.

NOTICE:

All the stored DTCs and freeze frame data are cleared if: 1) the ECM is changed from normal mode to check mode or vice versa; or 2) the power switch is turned from on (IG) to on (ACC) or off while in check mode. Before changing modes, always check and note any DTCs and freeze frame data.

1. CHECK MODE PROCEDURE

(a) Check and ensure the following conditions:

(1) Battery voltage 11 V or more.

(2) Throttle valve fully closed.

(3) Push the P position switch.

(4) A/C switch off.

(b) Turn the power switch off.

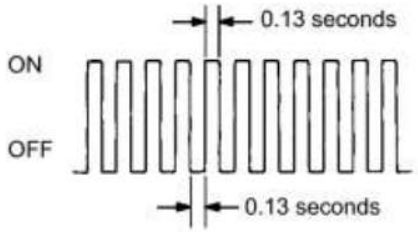
(c) Connect the Techstream to the DLC3.

(d) Turn the power switch on (IG).

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Utility / Check Mode.

(g) Switch the ECM from normal mode to check mode.



(h) Make sure that the MIL flashes as shown in the illustration.

(i) Turn the power switch on (READY).

(j) Make sure that the MIL turns off.

(k) Simulate that the conditions of the malfunction described by the customer.

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(l) Check DTCs and freeze frame data using the Techstream.

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FAIL-SAFE CHART

If any of the following DTCs are set, the ECM enters fail-safe mode to allow the vehicle to be driven temporarily or stops fuel injection.

DTC	Component	Fail-safe Operation	Fail-safe Deactivation Condition
P0031 P0032 P101D	Air fuel ratio sensor heater	ECM turns off air fuel ratio sensor heater	Power switch off
P0037 P0038 P102D	Heated oxygen sensor heater	ECM turns off heated oxygen sensor heater	Power switch off
P0102 P0103	Mass air flow meter sub-assembly	ECM calculates ignition timing according to engine speed and throttle valve position	Pass condition detected
P0106 P0107 P0108	Manifold absolute pressure sensor	ECM turns off EGR valve operate	Pass condition detected
P0112 P0113	Intake air temperature sensor	ECM estimates intake air temperature to be 20°C (68°F)	Pass condition detected
P0115 P0117 P0118	Engine coolant temperature sensor	ECM estimates engine coolant temperature to be 80°C (176°F)	Pass condition detected
P0120 P0121 P0122 P0123 P0220 P0222 P0223	Electronic throttle control system	ECM cuts off throttle actuator current and throttle valve returns to the 5.5° throttle position by return spring The ECM stops the engine and the vehicle can be driven using solely the hybrid system *1	Pass condition detected and then power switch turned off

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DTC	Component	Fail-safe Operation	Fail-safe Deactivation Condition
P0604 P0606 P0607 P060A P060B P060E P0657 P2102 P2103 P2111 P2112 P2118 P2119 P2135			
P0327 P0328	Knock control sensor	ECM sets ignition timing to maximum retard	Power switch off
P0351 to P0354	Ignition coil assembly (Igniter)	ECM cuts fuel	Pass condition detected
P0401	EGR valve assembly	ECM assumes that EGR valve is closed, so that ignition timing controlled to a safe value	Pass condition detected
P0403	EGR valve assembly	ECM assumes that EGR valve is closed, so that ignition timing controlled to a safe value	Pass condition detected
P216B	Water pump assembly	Output duty ratio of the WPO terminal repeats a cycle of 0% for 30 seconds and then 85% for 5 seconds*2	Power switch off
P261C	Water pump assembly	Output duty ratio of the WPO terminal remains at 0%*2	Power switch off
P261D	Water pump assembly	Output duty ratio of the WPO terminal remains at 0%*2	Power switch off

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HINT:

- *1: The vehicle can be driven slowly when the accelerator pedal is depressed firmly and slowly.
- *2: When the coolant temperature reaches 105°C (221°F), the engine is stopped and the hybrid system is solely used to driving vehicle.

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DATA LIST / ACTIVE TEST

1. DATA LIST

HINT:

Using the Techstream to read the Data List allows the values or states of switches, sensors, actuators and other items to be read without removing any parts. This non-intrusive inspection can be very useful because intermittent conditions or signals may be discovered before parts or wiring is disturbed. Reading the Data List information early in troubleshooting is one way to save diagnostic time.

NOTICE:

In the table below, the values listed under Normal Condition are reference only. Do not depend solely on these values when determining whether or not a part is faulty.

(a) Warm up the engine.

(b) Turn the power switch off.

(c) Connect the Techstream to the DLC3.

(d) Turn the power switch on (IG).

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Data List.

(g) According to the display on the Techstream, read the Data List.

Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Vehicle Speed	Vehicle speed: Min.: 0 mph (0 km/h), Max.: 159 mph (255 km/h)	Actual vehicle speed	Speed indicated on speedometer
Engine Speed	Engine speed: Min.: 0 rpm, Max.: 16383 rpm	950 to 1050 rpm: Idling	-
Calculate Load	Calculated load by ECM: Min.: 0%, Max.: 100%	• 20 to 40%: Idling • 15 to 35%: Running without load (2500 rpm)	-

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Vehicle Load	Vehicle load: Min.: 0%, Max.: 25700%	Actual vehicle load	Load percentage in terms of maximum intake air flow amount
MAF	Air flow rate from mass air flow meter sub-assembly: Min.: 0 gm/sec, Max.: 655.35 gm/sec	1 to 3 gm/sec: Idling 4.5 to 8.5 gm/sec: Running without load (2500 rpm)	If value approximately 0.0 gm/sec: • Mass air flow meter sub-assembly power source circuit open • VG circuit open or short If value 271.0 gm/sec or more: • E2G circuit open
Atmosphere Pressure	Atmospheric pressure: Min.: 0 kPa (0 mmHg), Max.: 255 kPa (1913 mmHg)	Equivalent to atmospheric pressure	-
MAP	Intake manifold pressure: Min.: 0 kPa (0 mmHg), (Max.: 255 kPa (1913 mmHg)	• 80 to 110 kPa (600 to 826 mmHg): Power switch on (IG) • 20 to 40 kPa (150 to 300 mmHg): Idling	-
Coolant Temp	Engine coolant temperature: Min.: -40°C (-40°F), Max.: 215°C (419°F)	80 to 100°C (176 to 212°F): After warming up	• If value -40°C (-40°F): sensor circuit open • If value 140°C (284°F) or more: sensor circuit shorted
Intake Air	Intake air temperature: Min.: -40°C (-40°F), Max.: 140°C (284°F)	Equivalent to ambient air temperature	• If value -40°C (-40°F): sensor circuit open • If value 140°C (284°F): sensor circuit shorted
Engine Run Time	Engine run time: Min.: 0 s (second), Max.: 65535 s (seconds)	Time since engine started	-
Initial Engine	Initial engine coolant	Coolant temperature when	Service data

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Coolant Temp	temperature: Min.: -40°C (-40°F), Max.: 119.3°C (246.8°F)	engine started	
Initial Intake Air Temp	Initial intake air temperature: Min.: -40°C (-40°F), Max.: 119.3°C (246.8°F)	Intake air temperature when engine started	Service data
Battery Voltage	Battery voltage: Min.: 0 V, Max.: 65.535 V	11 to 16 V: Idling	-
Throttle Sensor Volt %	Throttle valve opening percentage according to throttle position sensor: Min.: 0%, Max.: 100%	10 to 22%: Accelerator pedal released	Value calculated based on the voltage at terminal VTA1
Throttl Sensor #2 Volt %	Throttle valve opening percentage according to throttle position sensor No. 2: Min.: 0%, Max.: 100%	42 to 62%: Accelerator pedal released	Value calculated based on the voltage at terminal VTA2
System Guard	System guard: ON or OFF	-	Electronic throttle control system service data
Throttle Idle Position	Whether or not throttle position sensor detecting idling: ON or OFF	• ON: Accelerator pedal released • OFF: Accelerator pedal fully depressed	-
Throttle Require Position	Required throttle position: Min.: 0 V, Max.: 5 V	0.5 to 1.1 V: Idling	-
Throttle Sensor Position*1	Throttle position sensor:	0%: Accelerator pedal released	Recognition value for throttle opening angle on ECM

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
	Min.: 0%, Max.: 100%		
Throttle Position No. 1	Throttle position sensor No. 1 output voltage: Min.: 0 V, Max.: 4.98 V	-	Electronic throttle control system service data
Throttle Position No. 2	Throttle position sensor No. 2 output voltage: Min.: 0 V, Max.: 4.98 V	-	Electronic throttle control system service data
Throttle Position No. 1	Throttle position sensor No. 1: Min.: 0 V, Max.: 5 V	• 0.5 to 1.1 V: Accelerator pedal released • 0.6 to 1.4 V: Fail-safe operating	-
Throttle Position No. 2	Throttle position sensor No. 2: Min.: 0 V, Max.: 5 V	• 2.1 to 3.1 V: Accelerator pedal released • 2.1 to 3.1 V: Fail-safe operating	-
Throttle Position Command	Throttle position command value: Min.: 0 V, Max.: 4.9804 V	0.5 to 4.8 V	-
Throttle Sens Open Pos #1	Throttle sensor opener position No. 1: Min.: 0 V, Max.: 4.9804 V	0.6 to 1.4 V	Electronic throttle control system service data
Throttle Sens Open Pos #2	Throttle sensor opener position No. 2: Min.: 0 V, Max.: 4.9804 V	1.7 to 2.5 V	Electronic throttle control system service data
Throttle Motor Current	Throttle actuator current:	0 to 3.0 A: Idling	Electronic throttle control system service data

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
	Min.: 0 A, Max.: 20 A		
Throttle Motor DUTY	Throttle actuator: Min.: 0%, Max.: 100%	10 to 22%: Idling after engine warmed up	Electronic throttle control system service data
Throttle Motor Current	Throttle actuator current: Min.: 0 A, Max.: 19.92 A	0 to 3.0 A: Idling	-
Throttle Motor Open Duty	Throttle actuator open duty ratio: Min.: 0%, Max.: 255%	0 to 40%: Idling	When accelerator pedal depressed, duty ratio increased
Throttle Motor Close Duty	Throttle actuator close duty ratio: Min.: 0%, Max.: 255%	0 to 40%: Idling	When accelerator pedal released quickly, duty ratio increased
Throttle Motor Duty (Open)	Throttle actuator duty ratio (open): Min.: 0%, Max.: 255%	0 to 40%: Idling	Electronic throttle control system service data
Throttle Motor Duty (Close)	Throttle actuator duty ratio (close): Min.: 0%, Max.: 255%	0 to 40%: Idling	Electronic throttle control system service data
Throttle Fully Close Learn	Throttle valve fully closed (learned value): Min.: 0 V, Max.: 5 V	0.4 to 1.0 V: Accelerator pedal released	-
+BM Voltage	+BM voltage: Min.: 0, Max.: 19.92 V	11 to 16 V: Power switch on (IG) and system normal	Electronic throttle control system service data
Actuator Power Supply	Actuator power supply ON or OFF	ON: Idling	-
Injector (Port)	Injection duration for	1000 to 3000 µs: Idling	-

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
	cylinder 1: Min.: 0 µs, Max.: 65535 µs		
Injection Volum (Cylinder1)	Injection volume (Cylinder 1): Min.: 0 ml, Max.: 2.047 ml	0.03 to 0.13 ml: Idling	Quantity of fuel injection volume for 10 times
Fuel Pump/Speed Status	Fuel pump status: ON or OFF	-	Active Test support data
Vacuum Pump	Key-off EVAP system leak detection pump status: ON or OFF	-	Active Test support data
EVAP (Purge) VSV	EVAP (Purge) VSV control duty: Min.: 0%, Max.: 100%	0 to 50%: Idling, under purge control	Order signal from ECM
Evap Purge Flow	Ratio of evaporative purge flow to intake air volume: Min.: 0%, Max.: 399.9%	0 to 10%: Idling	Service data
Purge Density Learn Value	Learning value of purge density: Min.: -200, Max.: 199.993%	-40 to 10: Idling	Service data
Vapor Pressure Pump	Vapor pressure: Min.: 0 kPa (0 mmHg), Max.: 1441.77 kPa (10815.979 mmHg)	Approximately 100 kPa (750 mmHg) (absolute): Power switch on (IG)	EVAP system pressure monitored by canister pressure sensor
Vapor pressure (calculated)	Vapor pressure (calculated): Min.: -720.896 kPa (-5408.072 mmHg),	Approximately 100 kPa (750 mmHg) (absolute): Power switch on (IG)	EVAP system pressure monitored by canister pressure sensor

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
	Max.: 720.874 kPa (5407.070 mmHg)		
EVAP System Vent Valve	Key-off EVAP system vent valve status: ON or OFF	-	Active Test support data
EVAP Purge VSV	Purge VSV status for EVAP control: ON or OFF	-	Active Test support data
Purge Cut VSV Duty	Purge cut VSV duty: Min.: 0%, Max.: 399.9%	-	-
Target Air-Fuel Ratio	Ratio compared to stoichiometric level: Min.: 0, Max.: 1.99	0.8 to 1.2: Idling	-
AF Lambda B1 S1	Short-term fuel trim associated with bank 1 sensor 1: Min.: 0, Max.: 1.99	• Value less than 1 (0.000 to 0.999) = Rich • Stoichiometric air fuel ratio = 1 • Value greater than 1 (1.001 to 1.99) = Lean	-
AFS Voltage B1 S1	Air fuel ratio sensor output voltage for bank 1 sensor 1: Min.: 0 V, Max.: 7.99 V	2.6 to 3.8 V: Idling, engine warmed up	Performing Control the Injection Volume or Control the Injection Volume for A/F Sensor function of Active Test enables technician to check output voltage of sensors
AFS Current B1 S1	Air fuel ratio sensor output current for bank 1 sensor 1: Min.: -128 mA, Max.: 127.99 mA	-0.5 to 0.5 mA: Idling, engine warmed up	Value becomes higher when fuel-cut executed under high engine speed
A/F Heater Duty #1	Air fuel ratio heater duty ratio for bank 1: Min.: 0%, Max.: 399.9%	0 to 100%	-

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
O2S B1 S2	Heated oxygen sensor output voltage for bank 1 sensor 2: Min.: 0 V, Max.: 1.275 V	0.0 to 0.9 V: Driving at 44 mph (70 km/h)	Performing Control the Injection Volume or Control the Injection Volume for A/F Sensor function of Active Test enables technician to check output voltage of sensors
O2S Impedance B1S2	Heated oxygen sensor impedance (bank 1 sensor 2): Min.: 0 ohm, Max.: 21247.67 ohm	5 to 15000 ohm: After driving for 10 minutes or more in urban area	-
O2 Heater B1S2	Heated oxygen sensor heater for bank 1 sensor 2: Not Act or Active	-	-
O2 Heater Curr Val B1S2	Heated oxygen sensor current for bank 1 sensor 2: Min.: 0 A, Max.: 4.9 A	-	-
Short FT #1	Short-term fuel trim of bank 1: Min.: -100%, Max.: 99.2%	-20 to 20%	Short-term fuel compensation used to maintain air fuel ratio at stoichiometric air fuel ratio
Long FT #1	Long-term fuel trim of bank 1: Min.: -100%, Max.: 99.2%	-20 to 20%	Overall fuel compensation carried out long-term to compensate continual deviation of short-term fuel trim from central value
Total FT #1	Total fuel trim of bank 1 Average value for fuel trim system of bank 1: Min.: -0.5, Max.: 0.496	-0.28 to 0.2: Idling	-
Fuel System Status #1	Fuel system status (bank 1): OL or CL or OLDrive or OLFault or CLFault	CL: Idling after warming up	• OL (Open Loop): Has not yet satisfied conditions to go closed loop • CL (Closed Loop): Using air

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
			fuel ratio sensor as feedback for fuel control • OLDrive: Open loop due to driving conditions (fuel enrichment) • OLFault: Open loop due to detected system fault • CLFault: Closed loop but air fuel ratio sensor, which used for fuel control malfunctioning
Fuel System Status #2	Fuel system status (bank 2): OL or CL or OLDrive or OLFault or CLFault	Unused	• OL (Open Loop): Has not yet satisfied conditions to go closed loop • CL (Closed Loop): Using air fuel ratio sensor as feedback for fuel control • OLDrive: Open loop due to driving conditions (fuel enrichment) • OLFault: Open loop due to detected system fault • CLFault: Closed loop but air fuel ratio sensor, which used for fuel control malfunctioning
IGN Advance	Ignition timing advance for No. 1 cylinder: Min.: -64 deg., Max.: 63.5 deg.	BTDC 0 to 16 deg.: Idling	-
Knock Feedback Value	Feedback value of knocking: Min.: -1024 CA, Max.: 1024.0 CA	-20 to 0°CA: Driving at 44 mph (70 km/h)	Service data

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Knock Correct Learn Value	Correction learning value of knocking: Min.: -1024 CA, Max.: 1024.0 CA	0 to 22°CA: Driving at 44 mph (70 km/h)	Service data
Target EGR Position	Target EGR position: Min.: 0%, Max.: 100%	0%: Idling	-
EGR Step Position	EGR step position: Min.: 0 step, Max.: 120 step	0 step: Idling	-
VVT Control Status #1	VVT control (bank 1) status: ON or OFF	-	Active Test support data
VVT Aim Angle #1*2	VVT aim angle (bank 1): Min.: 0%, Max.: 399.9%	0 to 100%	VVT duty signal value during intrusive operation
VVT Change Angle #1*2	VVT change angle (bank 1): Min.: 0 DegFR, Max.: 639.9 DegFR	0 to 56 DegFR: Idling	Displacement angle during intrusive operation
VVT OCV Duty #1*2	VVT camshaft timing oil control valve assembly operation duty: Min.: 0%, Max.: 399.9%	0 to 100%	Requested duty value for intrusive operation
VN Turbo Type	Variable nozzle turbo type: Not Avl or Commo or Vacuum or CAN Com	Not Avl (Unused)	-
Catalyst Temp B1 S1	Catalyst temperature (associated with sensor 1): Min.: -40°C (-40°F), Max.: 6513.5°C	Close to catalyst inlet temperature	-

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
	(11756.3°F)		
Catalyst Temp B1 S2	Catalyst temperature (associated with sensor 2): Min.: -40°C (-40°F), Max.: 6513.5°C (11756.3°F)	Close to catalyst outlet temperature	-
Closed Throttle Position SW	Closed throttle position switch: ON or OFF	• ON: Throttle fully closed • OFF: Throttle open	-
Fuel Cut Condition	Fuel cut determination flag: ON or OFF	-	-
Check Mode	Check mode: ON or OFF	ON: Check mode ON	INFO
Misfire Test Result	Check mode result for misfire monitor: Compl or Incmpl	-	-
OXS1 Test Result	Check mode result for heated oxygen sensor (bank 1): Compl or Incmpl	-	-
A/F Test Results #1	Check mode result for air fuel ratio sensor (bank 1) Compl or Incmpl	-	-
Complete Parts Monitor	Comprehensive component monitor: Not Avl or Avail	-	-
Fuel System Monitor	Fuel system monitor: Not Avl or Avail	-	-
Misfire Monitor	Misfire monitor: Not Avl or Avail	-	-

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
EGR/VVT Monitor	EGR monitor: Not Avl or Avail	-	-
EGR/VVT Monitor	EGR monitor: Compl or Incmpl	-	-
O2S(A/FS) Heater Monitor	O2S (A/FS) heater monitor: Not Avl or Avail	-	-
O2S(A/FS) Heater Monitor	O2S (A/FS) heater monitor: Compl or Incmpl	-	-
O2S(A/FS) Monitor	O2S (A/FS) monitor: Not Avl or Avail	-	-
O2S(A/FS) Monitor	O2S (A/FS) monitor: Compl or Incmpl	-	-
A/C Monitor	A/C monitor: Not Avl or Avail	-	-
A/C Monitor	A/C monitor: Compl or Incmpl	-	-
2nd Air Monitor	2nd air monitor: Not Avl or Avail	-	-
2nd Air Monitor	2nd air monitor: Compl or Incmpl	-	-
EVAP Monitor	EVAP monitor: Not Avl or Avail	-	-
EVAP Monitor	EVAP monitor: Compl or Incmpl	-	-
Heated Catalyst Monitor	Heated catalyst monitor: Not Avl or Avail	-	-
Heated Catalyst Monitor	Heated catalyst	-	-

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
	monitor: Compl or Incmpl		
Catalyst Monitor	Catalyst monitor: Not Avl or Avail	-	-
Catalyst Monitor	Catalyst monitor: Compl or Incmpl	-	-
Component Monitor ENA	Comprehensive component monitor: Unable or Enable	-	-
Component Monitor CMPL	Comprehensive component monitor: Compl or Incmpl	-	-
Fuel System Monitor ENA	Fuel system monitor: Unable or Enable	-	-
Fuel System Monitor CMPL	Fuel system monitor: Compl or Incmpl	-	-
Misfire Monitor ENA	Misfire monitor: Unable or Enable	-	-
Misfire Monitor CMPL	Misfire monitor: Compl or Incmpl	-	-
EGR/VVT Monitor ENA	EGR monitor: Unable or Enable	-	-
EGR/VVT Monitor CMPL	EGR monitor: Compl or Incmpl	-	-
Heater Monitor ENA	O2S (A/FS) heater monitor: Unable or Enable	-	-
Heater Monitor CMPL	O2S (A/FS) heater monitor: Compl or Incmpl	-	-

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
O2S(A/FS) Monitor ENA	O2S (A/FS) monitor: Unable or Enable	-	-
O2S(A/FS) Monitor CMPL	O2S (A/FS) monitor: Compl or Incmpl	-	-
A/C Monitor ENA	A/C monitor: Unable or Enable	-	-
A/C Monitor CMPL	A/C monitor: Compl or Incmpl	-	-
2nd Air Monitor ENA	2nd air monitor: Unable or Enable	-	-
2nd Air Monitor CMPL	2nd air monitor: Compl or Incmpl	-	-
EVAP Monitor ENA	EVAP monitor: Unable or Enable	-	-
EVAP Monitor CMPL	EVAP monitor: Compl or Incmpl	-	-
Heated Cat Monitor ENA	Heated catalyst monitor: Unable or Enable	-	-
Heated Cat Monitor CMPL	Heated catalyst monitor: Compl or Incmpl	-	-
Catalyst Monitor ENA	Catalyst monitor: Unable or Enable	-	-
Catalyst Monitor CMPL	Catalyst monitor: Compl or Incmpl	-	-
TC Terminal	TC terminal status: ON or OFF	-	-
# Codes (Include History)	Number of emission related DTCs:	0: No emission related DTC detected	-

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
	Min.: 0 Max.: 255		
MIL	MIL status: ON or OFF	ON: MIL ON	-
MIL ON Run Distance	Distance traveled since MIL turned ON: Min.: 0 km (0 mile), Max.: 65535 km (40724 mile)	Distance since DTC detected	-
Running Time from MIL ON	Running time since MIL turned ON: Min.: 0 min, Max.: 65535 min	Equivalent to running time since MIL turned on	-
Time after DTC Cleared	Time since DTCs cleared: Min.: 0 min, Max.: 65535 min	Equivalent to time since DTCs cleared	-
Distance from DTC Cleared	Distance traveled since DTCs cleared: Min.: 0 km (0 mile), Max.: 65535 km (40724 mile)	Equivalent to distance driven since DTCs cleared	-
Warmup Cycle Cleard DTC	Warm-up cycles since DTCs cleared: Min.: 0, Max.: 255	-	Number of warm-up cycles since DTCs cleared
Dist Batt Cable Disconnect	Distance from battery cable disconnected: Min.: 0 km (0 mile), Max.: 65535 km (40724 mile)	-	-
IG OFF Elapsed Time	Time after power switch off: Min.: 0 min, Max.:	-	-

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
	655350 min		
OBD Requirements	OBD requirement	OBD2	-
Number of Emission DTC	Emission related DTCs Min.: 0 Max.: 127	-	Number of emission related DTCs
TC and TE1	TC and CG (TE1) terminals of DLC3: ON or OFF	-	Active Test support data
Ignition Trig. Count	Ignition counter for calculated misfire rate: Min.: 0, Max.: 65535	0 to 400	-
Cylinder #1 Misfire Count	Misfire count of cylinder 1: Min.: 0, Max.: 255	0	-
Cylinder #2 Misfire Count	Misfire count of cylinder 2: Min.: 0, Max.: 255	0	-
Cylinder #3 Misfire Count	Misfire count of cylinder 3: Min.: 0, Max.: 255	0	-
Cylinder #4 Misfire Count	Misfire count of cylinder 4: Min.: 0, Max.: 255	0	-
All Cylinders Misfire Count	All cylinders misfire count: Min.: 0, Max.: 255	0	-
Misfire RPM	Average of engine speed when misfire occurs: Min.: 0 rpm, Max.: 6375 rpm	0 rpm: Misfire 0	-
Misfire Load	Average of engine load when misfire	0 g/rev: Misfire 0	-

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
	occurred: Min.: 0 g/rev, Max.: 3.98 g/rev		
Electric Fan Motor	Electric cooling fan motor: ON or OFF	ON: Electric cooling fan motor operating	Active Test support data
Idle Fuel Cut Prohibit	Idle fuel cut prohibit: ON or OFF	-	-
Idle Fuel Cut	Fuel cut idle: ON or OFF	ON: Fuel cut operating	Idle Fuel Cut = "ON" when throttle valve fully closed and engine speed over 2800 rpm
FC TAU	Fuel cut TAU (Fuel cut with very light load): ON or OFF	ON: Fuel cut operating	Fuel cut being performed during very light load to prevent incomplete engine combustion
Communication with HV	Status of communication with the power management control ECU: Comm or No Comm	Comm: Power switch on (IG)	-
Communication with Brake	Status of communication with the skid control ECU: Comm or No Comm	Comm: Power switch on (IG)	-
Comm with Air Conditioner	Status of communication with the air conditioning amplifier assembly: Comm or No Comm	Comm: Power switch on (IG)	-
Model Code	Model code	-	Identifies model code: ZVW3##
Engine Type	Engine type	-	Identifies engine type: 2ZRFXE
Cylinder Number	Cylinder number:	-	Identifies number of cylinders:

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
	Min.: 0, Max.: 255		4
Destination	Destination	-	Identifies destination: A (America)
Model Year	Model year: Min.: 1900, Max.: 2155	-	Identifies model year: 2010
System Identification	System identification	-	Identifies engine system: HV (Hybrid)
Engine Speed of Cyl #1	Engine speed for cylinder 1: Min.: 0 rpm, Max.: 51199 rpm	-	Output only when Check the Cylinder Compression performed using Active Test 51199 rpm: Active Test not performed
Engine Speed of Cyl #2	Engine speed for cylinder 2: Min.: 0 rpm, Max.: 51199 rpm	-	Output only when Check the Cylinder Compression performed using Active Test 51199 rpm: Active Test not performed
Engine Speed of Cyl #3	Engine speed for cylinder 3: Min.: 0 rpm, Max.: 51199 rpm	-	Output only when Check the Cylinder Compression performed using Active Test 51199 rpm: Active Test not performed
Engine Speed of Cyl #4	Engine speed for cylinder 4: Min.: 0 rpm, Max.: 51199 rpm	-	Output only when Check the Cylinder Compression performed using Active Test 51199 rpm: Active Test not performed
Av Engine Speed of All Cyl	Engine speed for all cylinders: Min.: 0 rpm, Max.: 51199 rpm	-	Output only when Check the Cylinder Compression performed using Active Test 51199 rpm: Active Test not performed
Requested Engine Torque	Requested engine torque: Min.: 0 kW, Max.: 16383.75 kW	0 to 73 kW	Flag information for hybrid vehicle

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
HV Target Engine Speed	Hybrid target engine speed: Min.: 0 rpm, Max.: 6375 rpm	0 to 5200 rpm	Flag information for hybrid vehicle
Actual Engine Torque	Actual engine torque: Min.: -32768 Nm, Max.: 32768 Nm	Actual engine torque	Flag information for hybrid vehicle
Engine Run Time	Engine run time: Min.: 0 s (seconds), Max.: 255 s (seconds)	0 to 255 s	Flag information for hybrid vehicle
Request Engine Run Time	Request engine run time: Min.: 0 s (seconds), Max.: 25.5 s (seconds)	0 to 25.5 s	Flag information for hybrid vehicle
Judge Time Engine Ignition	Judgment time for complete explosion of ignition: Min.: 0 s (seconds), Max.: 25.5 s (seconds)	0 to 25.5 s	Flag information for hybrid vehicle
Judge Time Engine Output	Judgment time for time until engine output: Min.: 0 s (seconds), Max.: 25.5 s (seconds)	0 to 25.5 s	Flag information for hybrid vehicle
ISC Learning	Idle speed control learning: Compl or Incmpl	-	Flag information for hybrid vehicle
F/C for Engine Stop Req	Fuel cut for engine stop request: ON or OFF	-	Flag information for hybrid vehicle
Engine Independent	Engine independent operation: Not Opr or Operate	-	Flag information for hybrid vehicle
Racing Operation	Racing operation: Not Opr or Operate	-	Flag information for hybrid vehicle

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Tester Display	Measurement Item/Range	Normal Condition	Diagnostic Note
Request Warm-up	Request engine warm up: Not Req or Request	-	Flag information for hybrid vehicle
Engine Independent Control	Engine independent control operation: Not Opr or Operate	-	Flag information for hybrid vehicle
Elec Water Pump Target Spd	Electronic water pump target speed Min.: 0 rpm, Max.: 6375 rpm	-	-
Elec Water Pump Spd	Electronic water pump speed Min.: 0 rpm, Max.: 6375 rpm	-	-
ISC Learning Value	Idle speed control learning value: Min.: 0 L/s, Max.: 79.998 L/s	0.5 to 6.1 L/s	Flag information for hybrid vehicle

HINT:

- Normal condition: If no idling conditions are specified, the shift lever should be in N or P, and the A/C switch and all accessory switches should be off.
- *1: Excluding throttle valve opening percentage due to Idle Speed Control (ISC).
- *2: Values are only displayed when performing the Active Tests: Control the VVT Linear (Bank1). For other Active Tests, the value will be 0.

2. ACTIVE TEST

HINT:

Using the Techstream to perform the Active Tests allows relays, VSVs, actuators and other items to be operated without removing any parts. This non-intrusive functional inspection can be very useful because intermittent operation may be discovered before parts or wiring is disturbed. Performing Active Tests early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Tests.

(a) Warm up the engine.

(b) Turn the power switch off.

(c) Connect the Techstream to the DLC3.

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(d) Turn the power switch on (IG).

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test.

(g) According to the display on the Techstream, perform the Active Test.

Tester Display	Test Part	Control Range	Diagnostic Note
Control the Injection Volume	Change injection volume	-12.5 to 24.8%	• All injectors tested at the same time • Perform test at less than 3000 rpm • Injection volume can be changed in 1% graduations within control range
Control the Injection Volume for A/F Sensor	Change injection volume	Lower by 12.5% or increase by 25%	• Perform test at less than 3000 rpm • Control the Injection Volume for A/F Sensor enables checking and graphing of air fuel ratio sensor and heated oxygen sensor voltage outputs • When conducting the test, select the following items: Active Test / Control the Injection Volume for A/F Sensor / Data List / AFS Voltage B1S1 and O2S B1S2
Control the EGR Step Position	Open or close EGR valve	From 0 to 110 steps	• EGR valve fully closed at step position 0, and fully open at step position 110 • Amount of EGR gas, flowing into intake manifold, varies in accordance with EGR valve opening angle
Activate the VSV for Evap Control	Activate purge VSV control	ON/OFF	-
Control the Fuel Pump / Speed	Activate fuel pump (C/OPN Relay)	ON/OFF	Test possible when following conditions met: • Power switch on (IG) • Engine is stopped
Connect the TC and TE1	Turn on and off TC and CG (TE1) connection	ON/OFF	• ON: TC and TE1 connected • OFF: TC and TE1 disconnected

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Tester Display	Test Part	Control Range	Diagnostic Note
Control the Idle Fuel Cut Prohibit	Prohibit idling fuel cut control	ON/OFF	Idling fuel-cut turned ON when throttle valve fully closed and engine speed over 2800 rpm
Control the Electric Cooling Fan	Control electric cooling fan motor	ON/OFF	-
Control the ETCS Open/Close Slow Speed	Throttle actuator	Closed/Open	Test possible when following conditions met: • Power switch on (IG) • Engine is stopped • Accelerator pedal fully depressed (Accelerator pedal position: 58 degrees or more)
Control the ETCS Open/Close Fast Speed	Throttle actuator	Closed/Open	
Control the VVT Linear (Bank1)	Control VVT (bank 1)	Between -128 and 127% This value added to present camshaft timing oil control valve control duty 100%: Maximum advance -100%: Maximum retard	• Engine stall or rough idle when VVT actuator operated by 100%. • Test possible during idle.
Control the VVT System (Bank1)	Turn on and off intake camshaft timing oil control valve assembly	ON/OFF	• Engine stalls or idles roughly when camshaft timing oil control valve assembly turned on • Normal engine running or idling when camshaft timing oil control valve assembly off • Test possible during idle.
Activate the Vacuum Pump	Leak detection pump	ON/OFF	-
Activate the VSV for Vent Valve	Vent valve	ON/OFF	-
Control the Cylinder #1 Fuel Cut	Cylinder #1 injector fuel cut	ON/OFF	Test possible while vehicle stopped and engine idling
Control the Cylinder #2 Fuel Cut	Cylinder #2 injector fuel cut	ON/OFF	
Control the	Cylinder #3 injector	ON/OFF	

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Tester Display	Test Part	Control Range	Diagnostic Note
Cylinder #3 Fuel Cut	fuel cut		
Control the Cylinder #4 Fuel Cut	Cylinder #4 injector fuel cut	ON/OFF	
Control the All Cylinder Fuel Cut	All cylinder fuel cut	ON/OFF	
Check the Cylinder Compression*	Check the cylinder compression pressure (measure engine speed for each cylinder)	ON/OFF	Fuel injection and ignition stop in all cylinders
Activate the Electric Water Pump	Water pump assembly speed control	0 to 44800 rpm	Test possible when either of the following condition is met: • Engine coolant temperature is Below 100°C (212°F) • Not in inspection mode.

HINT:

*: While the Active Test item Check the Cylinder Compression is being performed, if one cylinder's speed is higher than the others, that cylinder's compression pressure can be concluded to be lower than the others.

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Put the engine in inspection mode INFO.
4. Start the engine and warm it up.
5. Turn the power switch off.
6. Turn the power switch on (IG) and turn the Techstream on.
7. Put the engine in inspection mode INFO.

   HINT:

   Do not start the engine.

8. Enter the following menus: Powertrain / Engine and ECT / Active Test / Check the Cylinder Compression.

   HINT:

   If the results are not displayed normally, select the display items from the Data List before performing the Active Test. Enter the following menus: Powertrain / Engine and ECT / Compression / Engine Speed of Cyl #1 to #4 and Av Engine Speed of All Cyl.

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9. While the engine is not running, press the RIGHT or LEFT button to change the Check the Cylinder Compression to ON.
10. Start the engine.
11. Monitor the engine speed (Engine Speed of Cyl #1 to #4, Av Engine Speed of All Cyl) displayed on the Techstream.

    HINT:

    At first, the Techstream display will show each cylinder's engine speed measurement to be extremely high. After the engine started, each cylinder's engine speed measurement will change to the actual engine speed.

    NOTICE:

    - When the Check the Cylinder Compression Active Test is ON and the engine will start.
    - If the Check the Cylinder Compression Active Test needs to be performed after it is turned ON and performed once, press EXIT to return to the Active Test menu screen. Then perform the Check the Cylinder Compression Active Test again.
    - Use a fully-charged battery.

3. SYSTEM CHECK

HINT:

Performing a System Check in the Utility menu enables the system, which consists of multiple actuators, to be operated without removing any parts. In addition, it can show whether or not any DTCs are set, and can detect potential malfunctions in the system.

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Utility.

(e) Perform the System Check by referring to the table below.

Tester Display	Test Part	Control Range	Diagnostic Note
Evaporative System Check (Automatic Mode)	Perform 5 steps in order to operate EVAP key-off monitor automatically	35°C (95°F) or less	• If no DTCs in Pending after performing this test, system functioning normally • Refer to EVAP System INFO
Evaporative System Check (Manual Mode)	Perform 5 steps in order to operate EVAP key-off monitor manually	35°C (95°F) or less	• Used to detect malfunctioning parts • Refer to EVAP System INFO

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DIAGNOSTIC TROUBLE CODE CHART

HINT:

Parameters listed in the chart may not be exactly the same as your readings due to the type of instrument or other factors. If a trouble code is displayed during the DTC check, inspect the trouble areas listed for that code. For details of the code, refer to the "See page" below.

*1: The MIL flashes when a catalyst damaging misfire is detected

*2: Only for MEXICO models

SFI System

DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
P0010	Camshaft Position "A" Actuator Circuit (Bank 1)	- Open or short in camshaft timing oil control valve assembly circuit - Camshaft timing oil control valve assembly - ECM	Comes on	DTC stored	Applies	INFO
P0011	Camshaft Position "A" - Timing Over-Advanced or System Performance (Bank 1)	- Valve timing - Camshaft timing oil control valve assembly - Oil control valve filter - Camshaft timing gear assembly - ECM	Comes on	DTC stored	Applies	INFO
P0012	Camshaft Position "A" - Timing Over-Retarded (Bank 1)	- Valve timing - Camshaft timing oil control valve assembly - Oil control valve filter - Camshaft timing gear assembly - ECM	Comes on	DTC stored	Applies	INFO
P0016	Crankshaft Position - Camshaft Position Correlation	- Valve timing	Comes on	DTC stored	Applies	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
	(Bank 1 Sensor A)	- Camshaft timing oil control valve assembly - Oil control valve filter - Camshaft timing gear assembly (for intake camshaft) - ECM				
P0031	Oxygen (A/F) Sensor Heater Control Circuit Low (Bank 1 Sensor 1)	- Open in air fuel ratio sensor (sensor 1) heater circuit - Air fuel ratio sensor heater (sensor 1) - ECM	Comes on	DTC stored	Applies	INFO
P0032	Oxygen (A/F) Sensor Heater Control Circuit High (Bank 1 Sensor 1)	- Short in air fuel ratio sensor (sensor 1) heater circuit - Air fuel ratio sensor heater (sensor 1) - ECM	Comes on	DTC stored	Applies	INFO
P0037	Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 2)	- Open in heated oxygen sensor (sensor 2) heater circuit - Heated oxygen sensor (sensor 2) heater - ECM	Comes on	DTC stored	Applies	INFO
P0038	Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 2)	- Short in heated oxygen sensor (sensor 2) heater circuit - Heated oxygen sensor (sensor 2) heater - ECM	Comes on	DTC stored	Applies	INFO
P0101	Mass Air Flow Circuit Range / Performance Problem	- Mass air flow meter sub-assembly	Comes on	DTC stored	-	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
		- Intake system - PCV hose connections - EGR valve assembly				
P0102	Mass or Volume Air Flow Circuit Low Input	- Open or short in mass air flow meter sub-assembly circuit - Mass air flow meter sub-assembly - ECM	Comes on	DTC stored	Applies	INFO
P0103	Mass or Volume Air Flow Circuit High Input	- Open or short in mass air flow meter sub-assembly circuit - Mass air flow meter sub-assembly - ECM	Comes on	DTC stored	Applies	INFO
P0106	Manifold Absolute Pressure / Barometric Pressure Circuit Range / Performance Problem	- Intake system - Manifold absolute pressure sensor	Comes on	DTC stored	-	INFO
P0107	Manifold Absolute Pressure / Barometric Pressure Circuit Low Input	- Open or short in manifold absolute pressure sensor circuit - Manifold absolute pressure sensor - ECM	Comes on	DTC stored	Applies	INFO
P0108	Manifold Absolute Pressure / Barometric Pressure Circuit High Input	- Open or short in manifold absolute pressure sensor circuit - Manifold absolute pressure sensor - ECM	Comes on	DTC stored	Applies	INFO
P0111	Intake Air Temperature Sensor Gradient Too High	Mass air flow meter sub-assembly	Comes on	DTC stored	-	INFO
P0112	Intake Air Temperature Circuit Low Input	- Short in intake air	Comes on	DTC stored	Applies	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
		temperature sensor circuit - Intake air temperature sensor (built into mass air flow meter sub-assembly) - ECM				
P0113	Intake Air Temperature Circuit High Input	- Open in intake air temperature sensor circuit - Intake air temperature sensor (built into mass air flow meter sub-assembly) - ECM	Comes on	DTC stored	Applies	INFO
P0115	Engine Coolant Temperature Circuit Malfunction	- Open or short in engine coolant temperature sensor circuit - Engine coolant temperature sensor - ECM	Comes on	DTC stored	Applies	INFO
P0116	Engine Coolant Temperature Circuit Range / Performance Problem	- Water inlet with thermostat sub-assembly - Engine coolant temperature sensor	Comes on	DTC stored	Applies	INFO
P0117	Engine Coolant Temperature Circuit Low Input	- Short in engine coolant temperature sensor circuit - Engine coolant temperature sensor - ECM	Comes on	DTC stored	Applies	INFO
P0118	Engine Coolant Temperature Circuit High Input	- Open in engine coolant temperature sensor circuit - Engine coolant temperature sensor - ECM	Comes on	DTC stored	Applies	INFO
P011B	Engine Coolant Temperature / Intake Air Temperature Correlation	- Intake air temperature sensor - Engine coolant	Comes on	DTC stored	-	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
		temperature sensor - ECM				
P0120	Throttle / Pedal Position Sensor / Switch "A" Circuit Malfunction	- Throttle position sensor (built into throttle body assembly) - ECM	Comes on	DTC stored	Applies	INFO
P0121	Throttle / Pedal Position Sensor / Switch "A" Circuit Range / Performance Problem	- Throttle position sensor (built into throttle body assembly) - Throttle position sensor circuit - ECM	Comes on	DTC stored	Applies	INFO
P0122	Throttle / Pedal Position Sensor / Switch "A" Circuit Low Input	- Throttle position sensor (built into throttle body assembly) - Short in VTA1 circuit - Open in VC circuit - ECM	Comes on	DTC stored	Applies	INFO
P0123	Throttle / Pedal Position Sensor / Switch "A" Circuit High Input	- Throttle position sensor (built into throttle body assembly) - Open in VTA1 circuit - Open in E2 circuit - Short between VC and VTA1 circuits - ECM	Comes on	DTC stored	Applies	INFO
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	- Cooling system - Engine coolant temperature sensor - Water inlet with thermostat sub-assembly	Comes on	DTC stored	Applies	INFO
P0128	Coolant Thermostat (Coolant Temperature Below	- Water inlet with	Comes on	DTC stored	Applies	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
	Thermostat Regulating Temperature)	thermostat sub-assembly - Cooling system - Engine coolant temperature sensor - ECM				
P0136	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)	- Open or short in heated oxygen sensor (sensor 2) circuit - Heated oxygen sensor (sensor 2) - Heated oxygen sensor heater (sensor 2) - Air fuel ratio sensor (sensor 1) - Gas leaks from exhaust system - EGR valve assembly	Comes on	DTC stored	-	INFO
P0137	Oxygen Sensor Circuit Low Voltage (Bank 1 Sensor 2)	- Open or short in heated oxygen sensor (sensor 2) - Heated oxygen sensor (sensor 2) - Heated oxygen sensor heater (sensor 2) - Gas leak from exhaust system - EGR valve assembly	Comes on	DTC stored	Applies	INFO
P0138	Oxygen Sensor Circuit High Voltage (Bank 1 Sensor 2)	- Short in heated oxygen sensor (sensor 2) circuit - Heated oxygen sensor (sensor 2) - EGR valve assembly	Comes on	DTC stored	-	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
		- ECM - Air fuel ratio sensor (sensor 1)				
P0139	Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 2)	- Short in heated oxygen sensor (sensor 2) circuit - Heated oxygen sensor (sensor 2) - EGR valve assembly - ECM	Comes on	DTC stored	-	INFO
P0141	Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)	- Open or short in heated oxygen sensor (sensor 2) heater circuit - Heated oxygen sensor (sensor 2) heater - ECM	Comes on	DTC stored	-	INFO
P0171	System Too Lean (Bank 1)	- Intake system - Fuel injector assembly - Mass air flow meter sub-assembly - Engine coolant temperature sensor - Fuel pressure - Gas leaks from exhaust system - Open or short in air fuel ratio sensor (sensor 1) circuit - Air fuel ratio sensor (sensor 1) - PCV valve and hose - PCV hose connections	Comes on	DTC stored	Applies	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
		- EGR valve assembly - ECM				
P0172	System Too Rich (Bank 1)	- Fuel injector assembly - Mass air flow meter sub-assembly - Engine coolant temperature sensor - Ignition system - Fuel pressure - Gas leaks from exhaust system - Open or short in air fuel ratio sensor (sensor 1) circuit - Air fuel ratio sensor (sensor 1) - EGR valve assembly - ECM	Comes on	DTC stored	Applies	INFO
P0220	Throttle / Pedal Position Sensor / Switch "B" Circuit	- Throttle position sensor (built into throttle body assembly) - ECM	Comes on	DTC stored	Applies	INFO
P0222	Throttle / Pedal Position Sensor / Switch "B" Circuit Low Input	- Throttle position sensor (built into throttle body assembly) - Short in VTA2 circuit - Open in VC circuit - ECM	Comes on	DTC stored	Applies	INFO
P0223	Throttle / Pedal Position Sensor / Switch "B" Circuit High Input	- Throttle position sensor (built into throttle body assembly)	Comes on	DTC stored	Applies	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
		- Open in VTA2 circuit - Open in E2 circuit - Short between VC and VTA2 circuits - ECM				
P0300	Random / Multiple Cylinder Misfire Detected	- Open or short in engine wire harness - Connector connection - Vacuum hose connections - Ignition system - Fuel injector assembly - Fuel pressure - Mass air flow meter sub-assembly - Engine coolant temperature sensor - Compression pressure - Valve timing - PCV valve and hose - PCV hose connections - Intake system - EGR valve assembly - ECM	Comes on / Blinks*1	DTC stored	Applies	INFO
P0301	Cylinder 1 Misfire Detected	- Open or short in engine wire harness - Connector connection - Vacuum hose connections	Comes on / Blinks*1	DTC stored	Applies	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
		- Ignition system - Fuel injector assembly - Fuel pressure - Mass air flow meter sub-assembly - Engine coolant temperature sensor - Compression pressure - Valve timing - PCV valve and hose - PCV hose connections - Intake system - EGR valve assembly - ECM				
P0302	Cylinder 2 Misfire Detected	- Open or short in engine wire harness - Connector connection - Vacuum hose connections - Ignition system - Fuel injector assembly - Fuel pressure - Mass air flow meter sub-assembly - Engine coolant temperature sensor - Compression pressure	Comes on / Blinks*1	DTC stored	Applies	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
		- Valve timing - PCV valve and hose - PCV hose connections - Intake system - EGR valve assembly - ECM				
P0303	Cylinder 3 Misfire Detected	- Open or short in engine wire harness - Connector connection - Vacuum hose connections - Ignition system - Fuel injector assembly - Fuel pressure - Mass air flow meter sub-assembly - Engine coolant temperature sensor - Compression pressure - Valve timing - PCV valve and hose - PCV hose connections - Intake system - EGR valve assembly - ECM	Comes on / Blinks*1	DTC stored	Applies	INFO
P0304	Cylinder 4 Misfire Detected	- Open or short in engine wire harness	Comes on / Blinks*1	DTC stored	Applies	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
		- Connector connection - Vacuum hose connections - Ignition system - Fuel injector assembly - Fuel pressure - Mass air flow meter sub-assembly - Engine coolant temperature sensor - Compression pressure - Valve timing - PCV valve and hose - PCV hose connections - Intake system - EGR valve assembly - ECM				
P0327	Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)	- Short in knock control sensor circuit - Knock control sensor - ECM	Comes on	DTC stored	Applies	INFO
P0328	Knock Sensor 1 Circuit High Input (Bank 1 or Single Sensor)	- Open in knock control sensor circuit - Knock control sensor - ECM	Comes on	DTC stored	Applies	INFO
P0335	Crankshaft Position Sensor "A" Circuit	- Open or short in crankshaft position sensor circuit - Crankshaft position sensor	Comes on	DTC stored	Applies	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
		- No. 1 crankshaft position sensor plate - ECM				
P0340	Camshaft Position Sensor Circuit Malfunction	- Open or short in camshaft position sensor circuit - Camshaft position sensor - Intake camshaft - Jumped tooth of timing chain for intake camshaft - ECM	Comes on	DTC stored	Applies	INFO
P0342	Camshaft Position Sensor "A" Circuit Low Input (Bank 1 or Single Sensor)	- Open or short in camshaft position sensor circuit - Camshaft position sensor - Intake camshaft - Jumped tooth of timing chain for intake camshaft - ECM	Comes on	DTC stored	Applies	INFO
P0343	Camshaft Position Sensor "A" Circuit High Input (Bank 1 or Single Sensor)	- Open or short in camshaft position sensor circuit - Camshaft position sensor - Intake camshaft - Jumped tooth of timing chain for intake camshaft - ECM	Comes on	DTC stored	Applies	INFO
P0351	Ignition Coil "A" Primary / Secondary Circuit	- Ignition system - Open or short in IGF or IGT1 circuit between ignition coil assembly and ECM - No. 1 ignition coil	Comes on	DTC stored	Applies	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
		assembly - ECM				
P0352	Ignition Coil "B" Primary / Secondary Circuit	- Ignition system - Open or short in IGF or IGT2 circuit between ignition coil assembly and ECM - No. 2 ignition coil assembly - ECM	Comes on	DTC stored	Applies	INFO
P0353	Ignition Coil "C" Primary / Secondary Circuit	- Ignition system - Open or short in IGF or IGT3 circuit between ignition coil assembly and ECM - No. 3 ignition coil assembly - ECM	Comes on	DTC stored	Applies	INFO
P0354	Ignition Coil "D" Primary / Secondary Circuit	- Ignition system - Open or short in IGF or IGT4 circuit between ignition coil assembly and ECM - No. 4 ignition coil assembly - ECM	Comes on	DTC stored	Applies	INFO
P0401	Exhaust Gas Recirculation Flow Insufficient Detected	- EGR valve assembly - EGR passage - EGR with cooler pipe sub-assembly - Manifold absolute pressure sensor	Comes on	DTC stored	Applies	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
		- ECM				
P0403	Exhaust Gas Recirculation Control Circuit	- Open or short in EGR circuit - EGR valve assembly - ECM	Comes on	DTC stored	Applies	INFO
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	- Gas leaks from exhaust system - Air fuel ratio sensor (sensor 1) - Heated oxygen sensor (sensor 2) - Front exhaust pipe assembly (TWC: Front and rear catalyst) - EGR valve assembly	Comes on	DTC stored	Applies	INFO
P043E	Evaporative Emission System Reference Orifice Clog Up	- Canister pump module - Connector/wire harness (canister pump module - ECM) - ECM	Comes on	DTC stored	-	INFO
P043F	Evaporative Emission System Reference Orifice High Flow	- Canister pump module - Connector/wire harness (canister pump module - ECM) - ECM	Comes on	DTC stored	-	INFO
P0441	Evaporative Emission Control System Incorrect Purge Flow	- Purge VSV - Purge VSV circuit (between purge VSV and ECM) - Leakage from EVAP line (between purge VSV and intake manifold) - EVAP line clogged	Comes on	DTC stored	-	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
		(between purge VSV and canister) - EGR valve assembly - ECM				
P0443*2	Evaporative Emission Control System Purge Control Valve Circuit	- Open or short in purge VSV circuit - Purge VSV - ECM	Comes on	DTC stored	Applies	INFO
P0451	Evaporative Emission Control System Pressure Sensor Range / Performance	- Canister pump module - Connector/wire harness (canister pump module - ECM) - ECM	Comes on	DTC stored	-	INFO
P0452	Evaporative Emission Control System Pressure Sensor / Switch Low Input	- Canister pump module - Connector/wire harness (canister pump module - ECM) - ECM	Comes on	DTC stored	-	INFO
P0453	Evaporative Emission Control System Pressure Sensor / Switch High Input	- Canister pump module - Connector/wire harness (canister pump module - ECM) - ECM	Comes on	DTC stored	-	INFO
P0455	Evaporative Emission Control System Leak Detected (Gross Leak)	- Fuel cap (loose) - Leakage from EVAP line (canister - fuel tank) - Leakage from EVAP line (purge VSV - canister) - Leakage from canister pump module - Leakage from fuel tank	Comes on	DTC stored	-	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
		- Leakage from canister				
P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	- Fuel cap (loose) - Leakage from EVAP line (canister - fuel tank) - Leakage from EVAP line (purge VSV - canister) - Leakage from canister pump module - Leakage from fuel tank - Leakage from canister	Comes on	DTC stored	-	INFO
P0505	Idle Control System Malfunction	- Electronic throttle control system - Intake system - PCV hose connections - EGR valve assembly - ECM	Comes on	DTC stored	Applies	INFO
P050A	Cold Start Idle Air Control System Performance	- Throttle body assembly - Mass air flow meter sub-assembly - PCV system - Air cleaner filter element sub-assembly - Intake system - VVT system - EGR valve assembly - ECM	Comes on	DTC stored	-	INFO
P050B	Cold Start Ignition Timing Performance	- Throttle body assembly - Mass air flow meter sub-	Comes on	DTC stored	-	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
		assembly - Intake system - PCV hose connections - VVT system - Air cleaner filter element sub-assembly - EGR valve assembly - ECM				
P0560	System Voltage	- Open in back up power source circuit - Battery - Battery terminals - EFI MAIN fuse - ECM	Comes on	DTC stored	Applies	INFO
P0604	Random Access Memory (RAM)	ECM	Comes on	DTC stored	Applies	INFO
P0606	ECM / PCM Processor	ECM	Comes on	DTC stored	Applies	INFO
P0607	Control Module Performance	- ECM - Heated oxygen sensor - Exhaust gas leak	Comes on	DTC stored	Applies	INFO
P060A	Internal Control Module Monitoring Processor Performance	ECM	Comes on	DTC stored	Applies	INFO
P060B	Internal Control Module A/D Processing Performance	ECM	Comes on	DTC stored	Applies	INFO
P060E	Internal Control Module Throttle Position Performance	ECM	Comes on	DTC stored	Applies	INFO
P062F	Internal Control Module EEPROM Error	ECM	Comes on	DTC stored	Applies	INFO
P0657	Actuator Supply Voltage Circuit / Open	ECM	Comes on	DTC stored	Applies	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
P101D	A/F Sensor Heater Circuit Performance Bank 1 Sensor 1 Stuck ON	ECM	Comes on	DTC stored	Applies	INFO
P102D	O2 Sensor Heater Circuit Performance Bank 1 Sensor 2 Stuck ON	ECM	Comes on	DTC stored	Applies	INFO
P106A	Evaporative Emission System Pressure Sensor - Manifold Absolute Pressure Correlation	- Canister pressure sensor (canister assembly) - Manifold absolute pressure sensor	Comes on	DTC stored	-	INFO
P2102	Throttle Actuator Control Motor Circuit Low	- Open in throttle actuator circuit - Throttle actuator - ECM	Comes on	DTC stored	Applies	INFO
P2103	Throttle Actuator Control Motor Circuit High	- Short in throttle actuator circuit - Throttle actuator - Throttle valve - Throttle body assembly - ECM	Comes on	DTC stored	Applies	INFO
P2111	Throttle Actuator Control System - Stuck Open	- Throttle actuator - Throttle body assembly - Throttle valve - ECM	Comes on	DTC stored	Applies	INFO
P2112	Throttle Actuator Control System - Stuck Closed	- Throttle actuator - Throttle body assembly - Throttle valve - ECM	Comes on	DTC stored	Applies	INFO
P2118	Throttle Actuator Control Motor Current Range / Performance	- Open in electronic throttle control system power source circuit	Comes on	DTC stored	Applies	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
		- Battery - Battery terminals - ETCS fuse - ECM				
P2119	Throttle Actuator Control Throttle Body Range / Performance	- Electronic throttle control system - ECM	Comes on	DTC stored	Applies	INFO
P2135	Throttle / Pedal Position Sensor / Switch "A" / "B" Voltage Correlation	- Short between VTA1 and VTA2 circuits - Throttle position sensor (built into throttle body assembly) - ECM	Comes on	DTC stored	Applies	INFO
P2195	Oxygen (A/F) Sensor Signal Stuck Lean (Bank 1 Sensor 1)	- Open or short in air fuel ratio sensor (sensor 1) circuit - Air fuel ratio sensor (sensor 1) - Air fuel ratio sensor (sensor 1) heater - Air fuel ratio sensor heater circuit - Intake system - Fuel pressure - Fuel injector assembly - EGR valve assembly - ECM	Comes on	DTC stored	-	INFO
P2196	Oxygen (A/F) Sensor Signal Stuck Rich (Bank 1 Sensor 1)	- Open or short in air fuel ratio sensor (sensor 1) circuit - Air fuel ratio sensor	Comes on	DTC stored	-	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
		(sensor 1) - Air fuel ratio sensor (sensor 1) heater - Air fuel ratio sensor heater circuit - Intake system - Fuel pressure - Fuel injector assembly - EGR valve assembly - ECM				
P2237	Oxygen (A/F) Sensor Pumping Current Circuit / Open (Bank 1 Sensor 1)	- Open in air fuel ratio sensor (sensor 1) circuit - Air fuel ratio sensor (sensor 1) - ECM	Comes on	DTC stored	Applies	INFO
P2238	Oxygen (A/F) Sensor Pumping Current Circuit Low (Bank 1 Sensor 1)	- Open or short in air fuel ratio sensor (sensor 1) circuit - Air fuel ratio sensor (sensor 1) - ECM	Comes on	DTC stored	Applies	INFO
P2239	Oxygen (A/F) Sensor Pumping Current Circuit High (Bank 1 Sensor 1)	- Open or short in air fuel ratio sensor (sensor 1) circuit - Air fuel ratio sensor (sensor 1) - ECM	Comes on	DTC stored	Applies	INFO
P2252	Oxygen (A/F) Sensor Reference Ground Circuit Low (Bank 1 Sensor 1)	- Open or short in air fuel ratio sensor (sensor 1) circuit - Air fuel ratio sensor	Comes on	DTC stored	Applies	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
		(sensor 1) - ECM				
P2253	Oxygen (A/F) Sensor Reference Ground Circuit High (Bank 1 Sensor 1)	- Open or short in air fuel ratio sensor (sensor 1) circuit - Air fuel ratio sensor (sensor 1) - ECM	Comes on	DTC stored	Applies	INFO
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	- Canister pump module - Connector/wire harness (canister pump module - ECM) - ECM	Comes on	DTC stored	-	INFO
P2402	Evaporative Emission System Leak Detection Pump Control Circuit High	- Canister pump module - Connector/wire harness (canister pump module - ECM) - ECM	Comes on	DTC stored	-	INFO
P2419	Evaporative Emission System Switching Valve Control Circuit Low	- Canister pump module - Connector/wire harness (canister pump module - ECM) - ECM	Comes on	DTC stored	-	INFO
P2420	Evaporative Emission System Switching Valve Control Circuit High	- Canister pump module (0.02 inch orifice, vacuum pump, vent valve) - Connector/wire harness (canister pump module - ECM) - ECM	Comes on	DTC stored	-	INFO
P2610	ECM / PCM Internal Engine Off Timer Performance	ECM	Comes on	DTC stored	Applies	INFO
P261B	Coolant Pump "B" Control Malfunction	- Open or short in water	Comes on	DTC stored	Applies	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
		pump assembly circuit - Water pump assembly - ECM				
P261C	Short in Coolant Pump "B" Control Circuit	- Short in water pump assembly circuit - Water pump assembly - ECM	Comes on	DTC stored	Applies	INFO
P261D	Open in Coolant Pump "B" Control Circuit	- Open in water pump assembly circuit - Water pump assembly - ECM	Comes on	DTC stored	Applies	INFO
P2A00	A/F Sensor Circuit Slow Response (Bank 1 Sensor 1)	- Air fuel ratio sensor - Air fuel ratio sensor heater - EGR valve assembly - ECM	Comes on	DTC stored	-	INFO
P3190	Poor Engine Power	- Intake system - Throttle body assembly - Fuel pressure - Engine - Mass air flow meter sub-assembly - Out of fuel - Engine coolant temperature sensor - Crankshaft position sensor - Camshaft position sensor - EGR valve assembly	Comes on	DTC stored	Applies	INFO

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DTC Code	Detection Item	Trouble Area	MIL	Memory	DTC for Mexico Models	See page
		- ECM				
P3191	Engine does not Start	- Intake system - Throttle body assembly - Fuel pressure - Engine - Mass air flow meter sub-assembly - Out of fuel - Engine coolant temperature sensor - Crankshaft position sensor - Camshaft position sensor - EGR valve assembly - ECM	Comes on	DTC stored	Applies	INFO
P3193	Fuel Run Out	- Out of fuel - ECM	Does not come on	DTC stored	Applies	INFO
U0293	Lost Communication with HV ECU	- Wire harness - Power management control ECU	Comes on	DTC stored	Applies	INFO

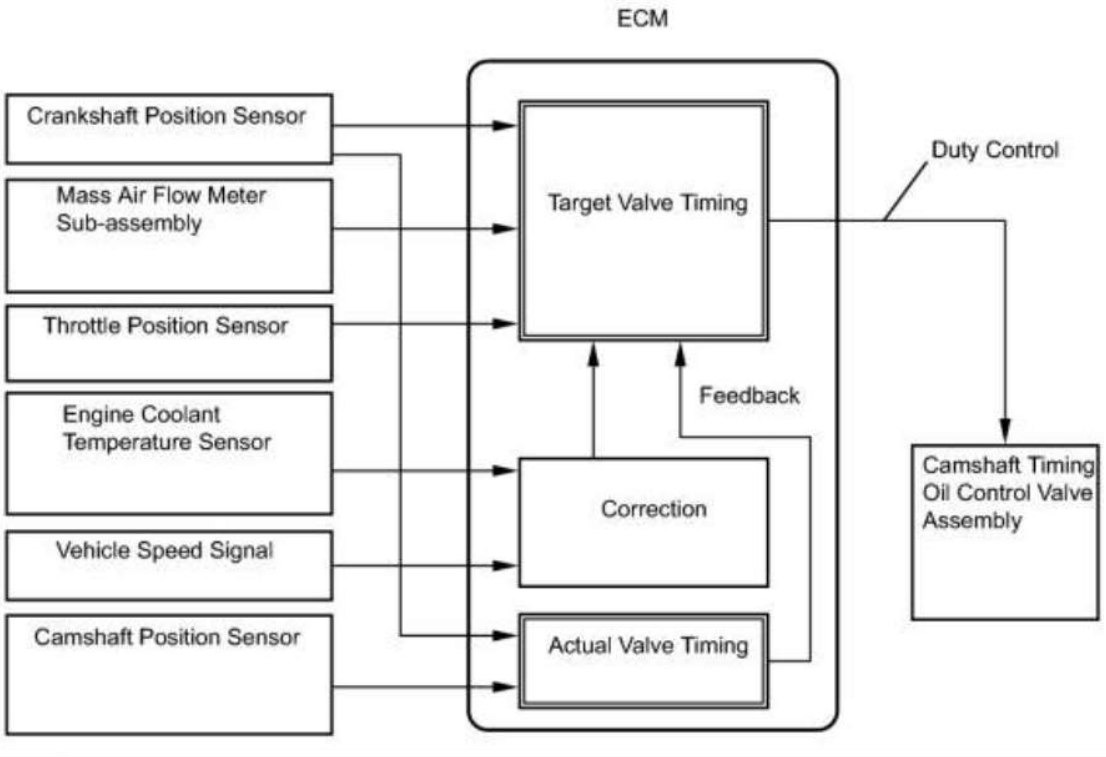
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DTC	P0010	Camshaft Position "A" Actuator Circuit (Bank 1)

DESCRIPTION

The VVT (variable valve timing) system adjusts the intake valve timing to improve driveability. The engine oil pressure turns the VVT controller to adjust the valve timing.

The camshaft timing oil control valve assembly is a solenoid valve and switches the engine oil line. The valve moves when the ECM applies the 12 V to the solenoid. The ECM changes the energizing time to the solenoid (duty-cycle) in accordance with the camshaft position, crankshaft position, throttle position, etc.



N

DTC No.	DTC Detection Condition	Trouble Area
P0010	Open or short in camshaft timing oil control valve assembly circuit (1 trip detection logic)	• Open or short in camshaft timing oil control valve assembly circuit • Camshaft timing oil control valve assembly • ECM

MONITOR DESCRIPTION

This DTC is designed to detect open or short circuits in the camshaft timing oil control valve assembly circuit. If the camshaft timing oil control valve's duty-cycle is excessively high or low while the engine is running, the ECM will illuminate the MIL and set the DTC.

MONITOR STRATEGY

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Related DTCs	P0010: Camshaft timing oil control valve range check (bank 1)
Required Sensors/Components (Main)	Camshaft timing oil control valve assembly
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	1 second
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
All of the following conditions are met	A, B, C and D
A. Starter	OFF
B. Power switch	On (IG)
C. Time after power switch off to on (IG)	0.5 seconds or more
D. Either of the following condition is met	(a) or (b)
(a) All of the following conditions are met	1, 2 and 3
1. Battery voltage	11 to 13 V
2. CPU commanded duty	Less than 70%
3. Current cut status	Not cut
(b) All of the following conditions are met	4, 5 and 6
4. Battery voltage	13 V or more
5. CPU commanded duty	Less than 80%
6. Current cut status	Not cut

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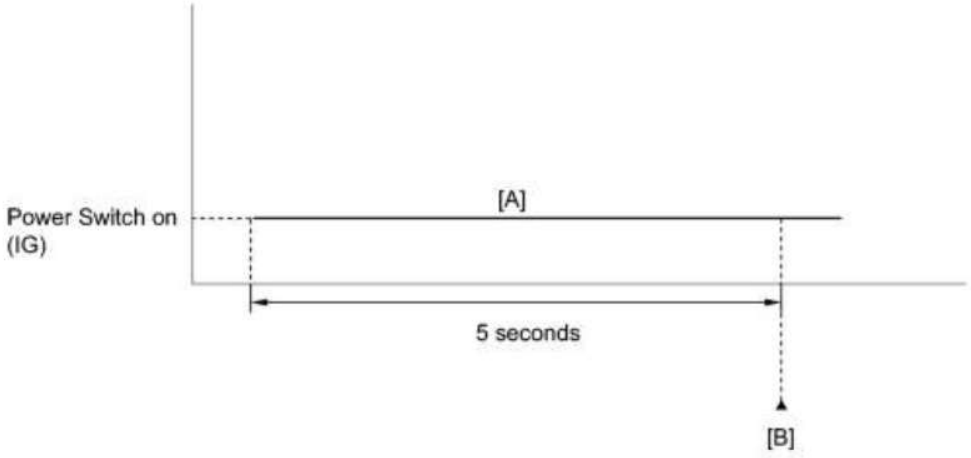
TYPICAL MALFUNCTION THRESHOLDS

VVT oil control valve condition	No operation record

COMPONENT OPERATING RANGE

VVT oil control valve condition	Operation record

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on.
6. Wait 5 seconds [A].
7. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
8. Read the DTC [B].
9. If a DTC is output, the system is malfunctioning.

   HINT:

   If a DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P0010.
12. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment

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Techstream Display	Description
	○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform step [A] again.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Check the judgment result.

HINT:

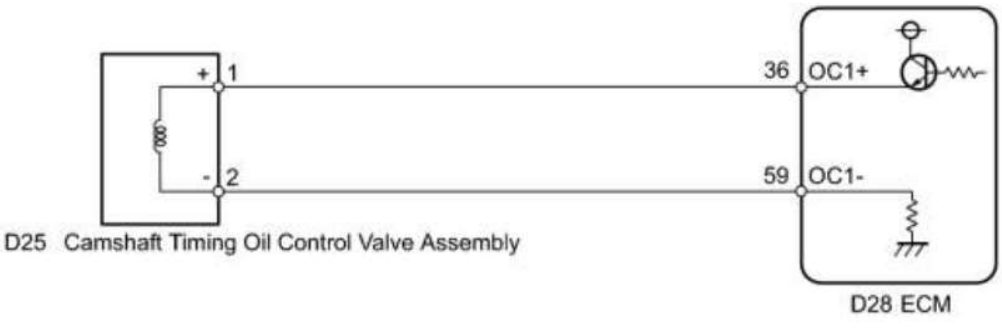
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

15. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



Y

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if

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the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	PERFORM ACTIVE TEST USING TECHSTREAM (OPERATE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine.

(f) Warm up the engine.

(g) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the VVT System (Bank 1).

(h) Check the engine speed while operating the camshaft timing oil control valve assembly using the Techstream.

Result:

Techstream Operation	Specified Condition
OFF	Normal engine speed
ON	Engine idles roughly or stalls (soon after camshaft timing oil control valve assembly switched from OFF to ON)

HINT:

If the result is not acceptable, cool the engine and perform the Active Test again.

(i) Start the engine when the engine coolant temperature is 30°C (86°F) or less.

(j) Turn the Techstream on.

(k) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the VVT System (Bank 1).

(l) Check the engine speed while operating the camshaft timing oil control valve assembly (for intake camshaft) using the Techstream with the engine coolant temperature is 50°C (122°F) or less.

Result:

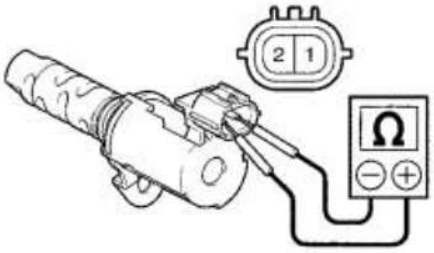
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Techstream Operation	Specified Condition
OFF	Normal engine speed
ON	Engine idles roughly or stalls (soon after camshaft timing oil control valve assembly switched from OFF to ON)

NG ▶ INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY
OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

2.	INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

*1



(a) Remove the camshaft timing oil control valve assembly.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	6.9 to 7.9 Ω

Text in Illustration

*1	Component without harness connected (Camshaft Timing Oil Control Valve Assembly)

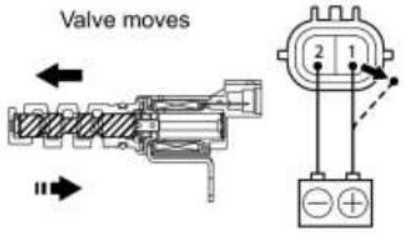
(c) Connect the positive (+) battery terminal to terminal 1 and connect the negative (-) battery terminal to terminal 2. Check the valve operation.

OK:

Valve moves quickly.

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Component without harness connected:
(Camshaft Timing Oil Control Valve Assembly)



Y

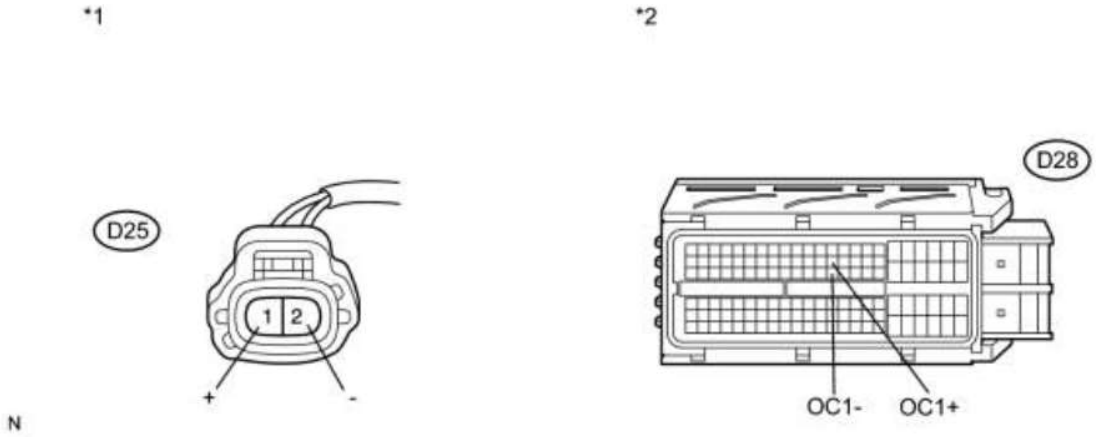
(d) Reinstall the camshaft timing oil control valve assembly.

NG ▶ REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

OK ▼

3.	CHECK HARNESS AND CONNECTOR (CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY - ECM)

(a) Disconnect the camshaft timing oil control valve assembly connector.



N

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D25-1 (+) - D28-36 (OC1+)	Always	Below 1 Ω
D25-2 (-) - D28-59 (OC1-)	Always	Below 1 Ω

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Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D25-1 (+) or D28-36 (OC1+) - Body ground	Always	10 kΩ or higher
D25-2 (-) or D28-59 (OC1-) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Camshaft Timing Oil Control Valve Assembly)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the camshaft timing oil control valve assembly connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY - ECM)

OK ▶ **REPLACE ECM**

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DTC	P0011	Camshaft Position "A" - Timing Over-Advanced or System Performance (Bank 1)
DTC	P0012	Camshaft Position "A" - Timing Over-Retarded (Bank 1)

DESCRIPTION

Refer to DTC P0010 INFO.

DTC No.	DTC Detection Condition	Trouble Area
P0011	Valve timing is not adjusted in valve timing advance range (1 trip detection logic)	• Valve timing • Camshaft timing oil control valve assembly • Oil control valve filter • Camshaft timing gear assembly • ECM
P0012	Valve timing is not adjusted in valve timing retard range (2 trip detection logic)	

MONITOR DESCRIPTION

The ECM optimizes the intake valve timing using the VVT (Variable Valve Timing) system to control the intake camshaft. The VVT system includes the ECM, the camshaft timing oil control valve assembly and the VVT controller. The ECM sends a target duty-cycle control signal to the camshaft timing oil control valve assembly. This control signal regulates the oil pressure supplied to the VVT controller. The VVT controller can advance or retard the intake camshaft.

If the difference between the target and actual intake valve timing is large, and changes in the actual intake valve timing are small, the ECM interprets this as a VVT controller stuck malfunction and sets a DTC.

- Example:
- A DTC is set when the following conditions "A" and "B" are met:

  a. It takes 5 seconds or more to change the valve timing by 5°CA (Condition "A").
  b. After the above condition is met, the camshaft timing oil control valve is forcibly activated for 10 seconds (Condition "B").

- The monitor will run if all of the following conditions are met:
- DTC P0011 (Advanced Cam Timing) is subject to 1 trip detection logic.
- DTC P0012 (Retarded Cam Timing) is subject to 2 trip detection logic.
- These DTCs indicate that the VVT controller cannot operate properly due to camshaft timing oil control valve assembly malfunctions or the presence of foreign objects in the camshaft timing oil control valve assembly.

- The engine is warm (the engine coolant temperature is 75°C (167°F) or more).
- The vehicle has been driven at 47 mph (75 km/h) or more.
- The engine has idled for 30 seconds or more.

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MONITOR STRATEGY

Related DTCs	P0011: Advanced camshaft timing P0012: Retarded camshaft timing
Required Sensors/Components (Main)	Camshaft timing oil control valve and VVT controller
Required Sensors/Components (Related)	Crankshaft position sensor Camshaft position sensor Engine coolant temperature sensor
Frequency of Operation	Once per driving cycle
Duration	Within 10 seconds
MIL Operation	Advanced camshaft timing: Immediately Retarded camshaft timing: 2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	P0010 (Camshaft timing oil control valve assembly Bank 1) P0016 (VVT System Bank 1 - Misalignment) P0102, P0103 (Mass Air Flow Meter sub-assembly) P0107, P0108 (Manifold Absolute Pressure) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0335 (Crankshaft Position Sensor)
Battery voltage	11 V or more
Engine RPM	500 to 4000 rpm
Engine coolant temperature	75 to 100°C (167 to 212°F)

TYPICAL MALFUNCTION THRESHOLDS

Advanced Camshaft Timing

All of the following conditions are met	-
Deviation of actual valve timing and target valve timing	More than 5°CA (crankshaft angle)
Valve timing	No change at advanced valve timing

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Retarded Camshaft Timing

All of the following conditions are met	-
Deviation of actual valve timing and target valve timing	More than 5°CA (crankshaft angle)
Valve timing	No change at retarded valve timing

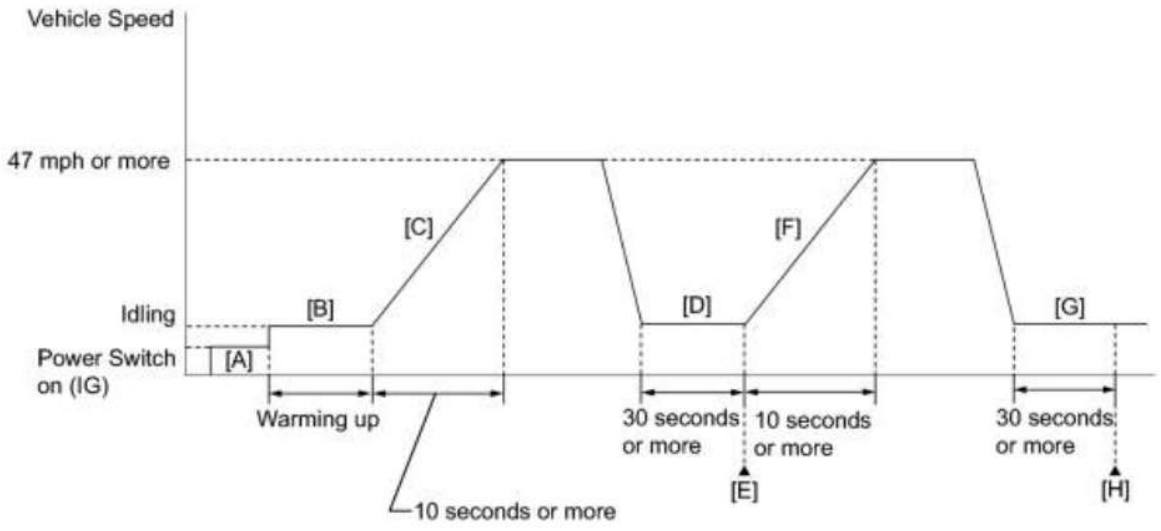
If the difference between the target and actual camshaft timing is greater than the specified value, the ECM operates the VVT actuator (camshaft timing oil control valve assembly).

Then, the ECM monitors the camshaft timing change for 10 seconds.

MONITOR RESULT

Refer to Checking Monitor Status INFO.

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.

   HINT:

   - P0011 is output:

     Clear the DTC without using the Techstream.

   - P0012 is output:

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Clear the DTC with using the Techstream.

4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more [B].
8. Accelerate the vehicle to 47 mph (75 km/h) or more for 10 seconds or more [C].
9. Idle the engine for 30 seconds or more [D].
10. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
11. Read the pending DTC [E].
12. If a pending DTC is output, the system is malfunctioning.

HINT:

If a pending DTC is not output, perform the following procedure.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Input the DTC: P0011 or P0012.
15. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

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CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [F] through [H].

16. Accelerate the vehicle to 47 mph (75 km/h) or more for 10 seconds or more [F].
17. Idle the engine for 30 seconds or more [G].
18. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
19. Input the DTC: P0011 or P0012.

20. Check the DTC judgment result again [H].

    HINT:

    - If the judgment result shows ABNORMAL, the system has a malfunction.
    - If the judgment result shows NORMAL, the system is normal.

21. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0010 INFO.

INSPECTION PROCEDURE

NOTICE:

DTC P0011 or P0012 may be set when foreign objects in the engine oil are caught in some parts of the system. The DTC will remain set even if the system returns to normal after a short time. Foreign objects are filtered out by the oil filter.

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0011 OR P0012)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result:

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Result	Proceed to
DTC P0011 or P0012 is output	A
DTC P0011 or P0012 and other DTCs are output	B

HINT:

If any DTCs other than P0011 or P0012 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	PERFORM ACTIVE TEST USING TECHSTREAM (OPERATE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine.

(f) Warm up the engine.

(g) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the VVT System (Bank 1).

(h) Check the engine speed while operating the camshaft timing oil control valve assembly using the Techstream.

Result:

Techstream Operation	Specified Condition
OFF	Normal engine speed
ON	Engine idles roughly or stalls (soon after camshaft timing oil control valve assembly switched from OFF to ON)

HINT:

If the result is not acceptable, cool the engine and perform the Active Test again.

(i) Start the engine when the engine coolant temperature is 30°C (86°F) or less.

(j) Turn the Techstream on.

(k) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the VVT System (Bank 1).

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(l) Check the engine speed while operating the camshaft timing oil control valve assembly using the Techstream with the engine coolant temperature at 50°C (122°F) or less.

Result:

Techstream Operation	Specified Condition
OFF	Normal engine speed
ON	Engine idles roughly or stalls (soon after camshaft timing oil control valve assembly switched from OFF to ON)

NG ▶ INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

OK ▼

3.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0011 OR P0012)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Put the engine in inspection mode INFO.

(f) Start the engine and warm it up.

(g) Driving the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(h) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(i) Read the pending DTCs.

Result:

Result	Proceed to
DTC is not output	A
DTC P0011 or P0012 is output	B

B ▶ ADJUST VALVE TIMING

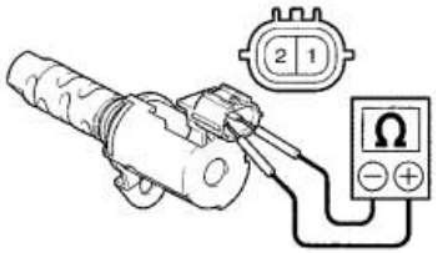
A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

4.	INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

(a) Remove the camshaft timing oil control valve assembly INFO.

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*1



(b) Measure the resistance according to the value(s) in the table below.

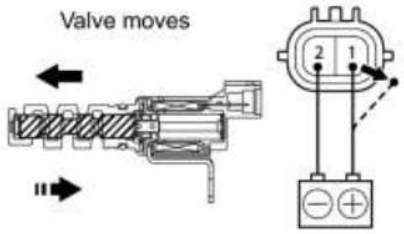
Standard Resistance:

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	6.9 to 7.9 Ω

Text in Illustration

*1	Component without harness connected (Camshaft Timing Oil Control Valve Assembly)

Component without harness connected:
(Camshaft Timing Oil Control Valve Assembly)



(c) Connect the positive (+) battery terminal to terminal 1 and connect the negative (-) battery terminal to terminal 2. Check the valve operation.

OK:

Valve moves quickly.

Y

(d) Reinstall the camshaft timing oil control valve assembly INFO.

NG ▶ REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

OK

▼

5.	INSPECT CAMSHAFT TIMING GEAR ASSEMBLY (FOR INTAKE CAMSHAFT)

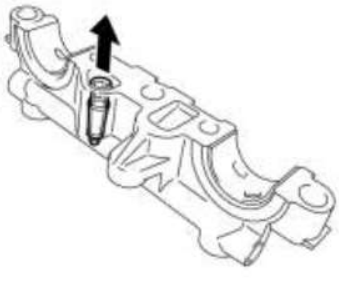
(a) Inspect the camshaft timing gear assembly (for intake camshaft) INFO.

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NG ▶ REPLACE CAMSHAFT TIMING GEAR ASSEMBLY (FOR INTAKE CAMSHAFT)

OK ▼

6.	INSPECT OIL CONTROL VALVE FILTER



T

(a) Remove the oil control valve filter INFO.

(b) Check that the filter is not clogged.

OK:

Filter is not clogged.

(c) Reinstall the oil control valve filter INFO.

NG ▶ REPLACE OIL CONTROL VALVE FILTER

OK ▼

7.	ADJUST VALVE TIMING

HINT:

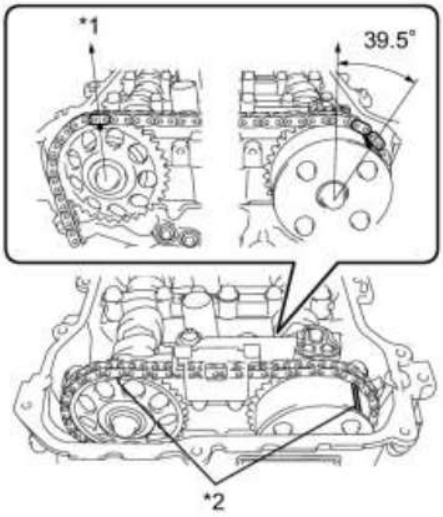
There are no marks on the cylinder head to match-up for the purpose of checking valve timing. Valve timing can only be inspected by lining up the colored plates on the timing chain with the marks on the pulleys. It may be necessary to remove and reinstall the chain to match-up the alignment marks INFO.

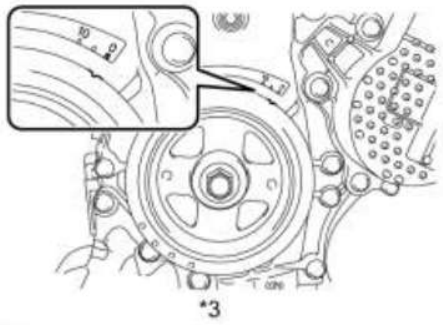
Text in Illustration

*1	Top
*2	Alignment Mark
*3	No. 1 Cylinder at TDC Compression

NEXT ▼

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C

8.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0011 OR P0012)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Put the engine in inspection mode INFO.

(f) Start the engine and warm it up.

(g) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(h) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(i) Read the pending DTCs.

Result:

Result	Proceed to

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Result	Proceed to
DTC is not output	A
DTC P0011 or P0012 is output	B

B ▶ REPLACE ECM

A ▶ **END**

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DTC	P0016	Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor A)

DESCRIPTION

The ECM optimizes the valve timing by using the VVT (Variable Valve Timing) system to control the intake camshaft. The VVT system includes the ECM, the camshaft timing oil control valve assembly and the VVT controller (camshaft timing gear assembly). The ECM sends a target duty-cycle control signal to the camshaft timing oil control valve assembly.

This control signal regulates the oil pressure supplied to the VVT controller. The VVT controller can advance or retard the intake camshaft.

DTC No.	Detection Condition	Trouble Area
P0016	Deviation in crankshaft position sensor signal and camshaft position sensor signal (2 trip detection logic)	• Valve timing • Camshaft timing oil control valve assembly • Oil control valve filter • Camshaft timing gear assembly (for intake camshaft) • ECM

MONITOR DESCRIPTION

To monitor the correlation of the intake camshaft position and crankshaft position, the ECM checks the VVT learning value while the engine is idling. The VVT learning value is calibrated based on the camshaft position and crankshaft position. The intake valve timing is set to the most retarded angle while the engine is idling. If the VVT learning value is out of specified range in consecutive driving cycles, the ECM illuminates the MIL and sets the DTC P0016.

This DTC indicates that the intake camshaft has been installed toward the crankshaft at an incorrect angle, caused by factors such as the timing chain having jumped a tooth.

This monitor begins to run after the engine has idled for 5 minutes.

MONITOR STRATEGY

Related DTCs	P0016: Camshaft Timing Misalignment at idling
Required Sensors/Components (Main)	VVT actuator
Required Sensors/Components (Related)	Camshaft position sensor Crankshaft position sensor
Frequency of Operation	Once per driving cycle
Duration	Within 60 seconds
MIL Operation	2 driving cycles

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Sequence of Operation	None

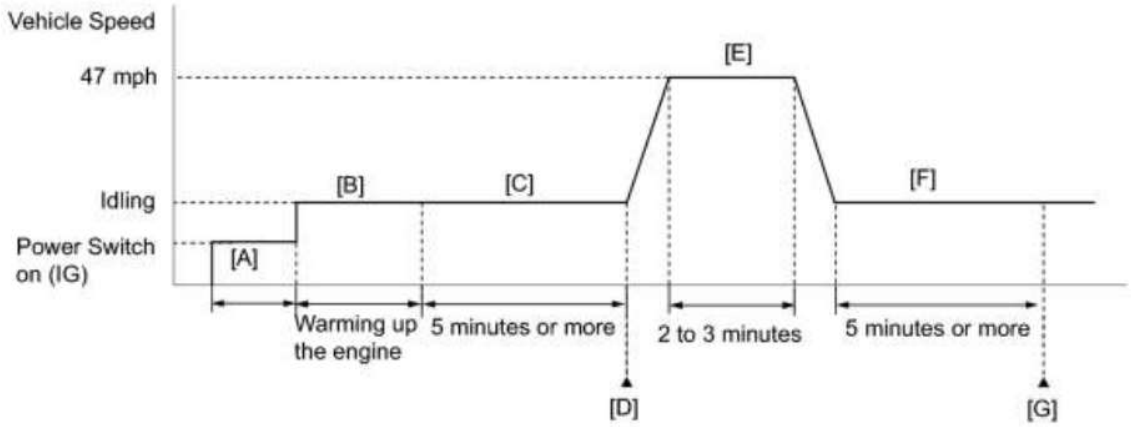
TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	P0010 (VVT Oil Control Valve Bank 1) P0102, P0103 (Mass Air Flow Meter Sub-assembly) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0335 (Crankshaft Position Sensor)
Engine RPM	900 to 1100 rpm

TYPICAL MALFUNCTION THRESHOLDS

One of the following conditions is met	-
VVT learning value at maximum retarded valve timing	Less than 22°CA (crankshaft angle)
VVT learning value at maximum retarded valve timing	More than 47°CA (crankshaft angle)

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.

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5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher [B].
8. Idle the engine for 5 minutes or more [C].
9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
10. Read the pending DTC [D].
11. If a pending DTC is output, the system is malfunctioning.

HINT:

If a pending DTC is not output, perform the following procedure.

12. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
13. Input the DTC: P0016.
14. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

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CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [E] through [G].

15. Drive the vehicle at 47 mph (75 km/h) for 2 to 3 minutes [E].
16. Idle the engine for 5 minutes or more [F].
17. Check the DTC judgment result [G].

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

18. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. Freeze frame data records the engine conditions when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0016)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result:

Result	Proceed to
DTC P0016 is output	A
DTC P0016 and other DTCs are output	B

HINT:

If any DTCs other than P0016 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	PERFORM ACTIVE TEST USING TECHSTREAM (OPERATE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY)

(a) Connect the Techstream to the DLC3.

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(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine.

(f) Warm up the engine.

(g) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the VVT System (Bank 1).

(h) Check the engine speed while operating the camshaft timing oil control valve assembly using the Techstream.

Result:

Techstream Operation	Specified Condition
OFF	Normal engine speed
ON	Engine idles roughly or stalls (soon after camshaft timing oil control valve assembly switched from OFF to ON)

HINT:

If the result is not acceptable, cool the engine and perform the Active Test again.

(i) Start the engine when the engine coolant temperature is 30°C (86°F) or less.

(j) Turn the Techstream on.

(k) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the VVT System (Bank 1).

(l) Check the engine speed while operating the camshaft timing oil control valve assembly using the Techstream with the engine coolant temperature at 50°C (122°F) or less.

Result:

Techstream Operation	Specified Condition
OFF	Normal engine speed
ON	Engine idles roughly or stalls (soon after camshaft timing oil control valve assembly switched from OFF to ON)

NG ▶ INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

OK ▼

3.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0016)

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(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Put the engine in inspection mode INFO.

(f) Start the engine and warm it up.

(g) Driving the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(h) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(i) Read the pending DTCs.

Result:

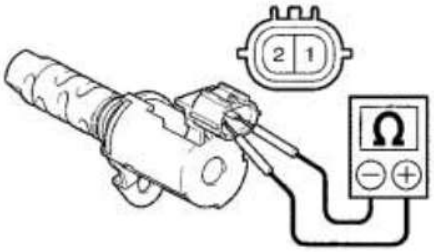
Result	Proceed to
DTC is not output	A
DTC P0016 is output	B

B ▶ ADJUST VALVE TIMING

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

4.	INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

*1



(a) Remove the camshaft timing oil control valve assembly INFO.

(b) Measure the resistance according to the value(s) in the table below.

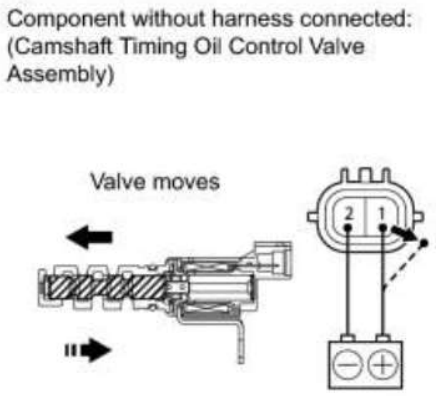
Standard Resistance:

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	6.9 to 7.9 Ω

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Text in Illustration

*1	Component without harness connected (Camshaft Timing Oil Control Valve Assembly)



(c) Connect the positive (+) battery terminal to terminal 1 and connect the negative (-) battery terminal to terminal 2. Check the valve operation.

OK:

Valve moves quickly.

Y

(d) Reinstall the camshaft timing oil control valve assembly INFO.

NG ▶ REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

OK ▼

5.	INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

(a) Inspect the camshaft timing gear assembly (for intake camshaft) INFO.

NG ▶ REPLACE CAMSHAFT TIMING GEAR ASSEMBLY

OK ▼

6.	INSPECT OIL CONTROL VALVE FILTER



(a) Remove the oil control valve filter INFO.

T

(b) Check that the filter is not clogged.

OK:

Filter is not clogged.

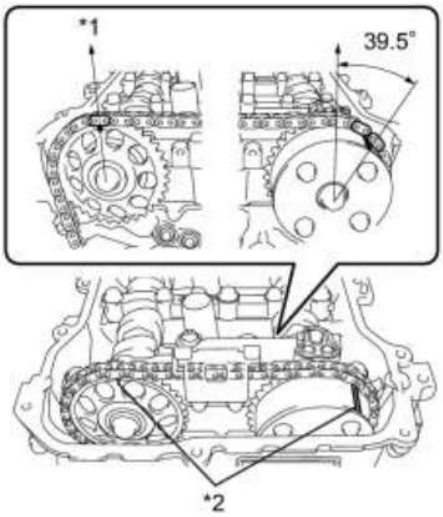
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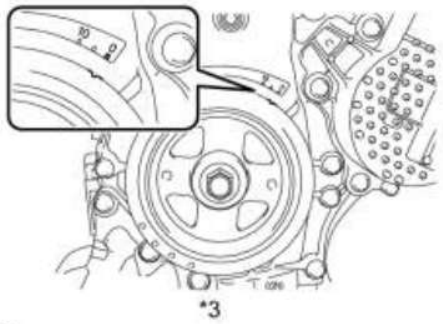
(c) Reinstall the oil control valve filter INFO.

NG ▶ REPLACE OIL CONTROL VALVE FILTER

OK ▼

7.	ADJUST VALVE TIMING





C

HINT:

There are no marks on the cylinder head to match-up for the purpose of checking valve timing. Valve timing can only be inspected by lining up the colored plates on the timing chain with the marks on the pulleys. It may be necessary to remove and reinstall the chain to match-up the alignment marks INFO.

Text in Illustration

*1	Top
*2	Alignment Mark
*3	No. 1 Cylinder at TDC Compression

NEXT ▼

8.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0016)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Put the engine in inspection mode INFO.

(f) Start the engine and warm it up.

(g) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

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(h) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(i) Read the pending DTCs.

Result:

Result	Proceed to
DTC is not output	A
DTC P0016 is output	B

B ▶ REPLACE ECM
A ▶ **END**

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DTC	P0031	Oxygen (A/F) Sensor Heater Control Circuit Low (Bank 1 Sensor 1)
DTC	P0032	Oxygen (A/F) Sensor Heater Control Circuit High (Bank 1 Sensor 1)
DTC	P101D	A/F Sensor Heater Circuit Performance Bank 1 Sensor 1 Stuck ON

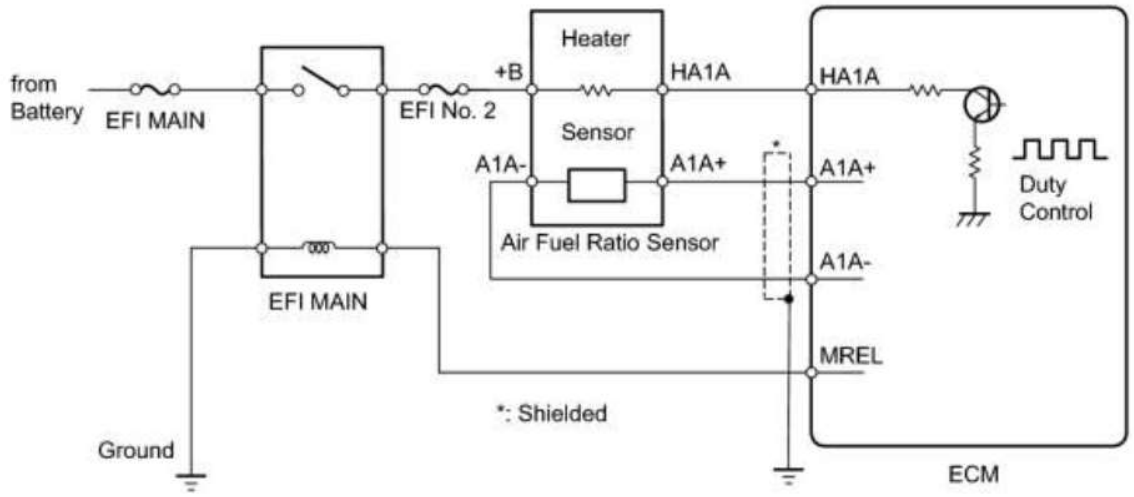
DESCRIPTION

Refer to DTC P2195 INFO.

HINT:

- When either of these DTCs is set, the ECM enters fail-safe mode. The ECM turns off the air fuel ratio sensor heater in fail-safe mode. Fail-safe mode continues until the power switch is turned off.
- Although the DTC titles say the oxygen sensor, these DTCs relate to the air fuel ratio sensor.
- Sensor 1 refers to the sensor mounted in front of the Three-way catalytic converter and located near the engine assembly.
- The ECM uses pulse width modulation to adjust the current through the heater. The air fuel ratio sensor heater circuit uses a relay on the +B side of the circuit.

Reference (System Diagram of Sensor 1):



DTC No.	DTC Detection Condition	Trouble Area
P0031	The heater current is less than the specified value while the heater is operating (1 trip detection logic).	• Open in air fuel ratio sensor (sensor 1) heater circuit • Air fuel ratio sensor heater (sensor 1) • ECM
P0032	An air fuel ratio sensor heater current failure (1 trip detection logic).	• Short in air fuel ratio sensor (sensor 1) heater circuit • Air fuel ratio sensor heater (sensor 1)

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DTC No.	DTC Detection Condition	Trouble Area
		• ECM
P101D	The heater current is higher than the specified value while the heater is not operating (1 trip detection logic).	ECM

HINT:

- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.

MONITOR DESCRIPTION

The ECM uses information from the air fuel ratio sensor to regulate the air fuel ratio and keep it close to the stoichiometric level. This maximizes the ability of the three-way catalytic converter to purify the exhaust gases.

The air fuel ratio sensor detects oxygen levels in the exhaust gas and transmits the information to the ECM. The inner surface of the sensor element is exposed to the outside air. The outer surface of the sensor element is exposed to the exhaust gas. The sensor element is made of platinum coated zirconia and includes an integrated heating element.

The zirconia element generates a small voltage when there is a large difference in the oxygen concentrations between the exhaust gas and outside air. The platinum coating amplifies this voltage generation.

The air fuel ratio sensor is more efficient when heated. When the exhaust gas temperature is low, the sensor cannot generate useful voltage signals without supplementary heating. The ECM regulates the supplementary heating using a duty-cycle approach to adjust the average current in the sensor heater element. If the heater current is outside the normal range, the signal transmitted by the air fuel ratio sensor becomes inaccurate, as a result, the ECM is unable to regulate air fuel ratio properly.

When the current in the air fuel ratio sensor heater is outside the normal operating range, the ECM interprets this as a malfunction in the sensor heater and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0031: Air fuel ratio sensor heater open/short (Low electrical current) P0032: Air fuel ratio sensor heater open/short (High electrical current) P101D: Air fuel ratio sensor heater performance
Required Sensors/Components (Main)	Air fuel ratio sensor heater
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	10 seconds: P0031

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	10.24 seconds: P0032 1 second: P101D
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

P0031:

Battery voltage	10.5 V or more
Time after engine start	10 seconds or more
Active heater OFF control	Not operating
Active heater ON control	Not operating
Heater output duty	50% or more

P0032:

Battery voltage	10.5 V or more
Time after engine start	10 seconds or more
Active heater OFF control	Not operating
Active heater ON control	Not operating
Heater output duty	More than 0%

P101D:

Battery voltage	10.5 V or more
Time after engine start	10 seconds or more
Air fuel ratio sensor heater duty-cycle ratio	10 to 60%
Air fuel ratio sensor heater ON current	0.8 A or more
Air fuel ratio sensor heater range check low current fail (P0031)	Not detected
Active heater OFF control	Not operating
Active heater ON control	Not operating

TYPICAL MALFUNCTION THRESHOLDS

P0031:

Air fuel ratio sensor heater ON current	Less than 0.8 A

P0032:

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Air fuel ratio sensor heater output	ON
Hybrid IC high current limiter monitor input	Fail

P101D:

Air fuel ratio sensor heater OFF current	More than 11 A
Active heater OFF control flag for ON stuck	ON
Hybrid IC high current limiter monitor input	Fail

COMPONENT OPERATING RANGE

P0031:

Air fuel ratio sensor heater ON current	0.8 A or more

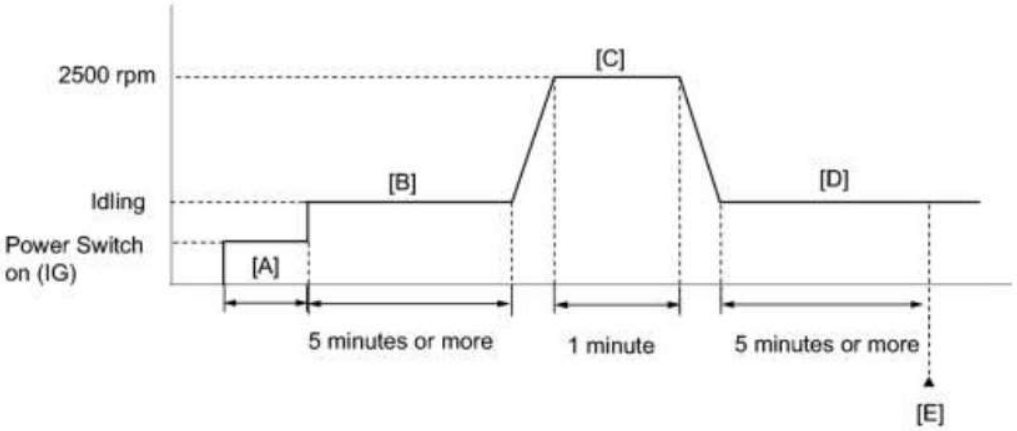
P0032:

All of the following conditions are met	-
1. Air fuel ratio sensor heater output	ON
2. Hybrid IC high current limiter monitor input	Pass

P101D:

Air fuel ratio sensor heater OFF current	11 A or less

CONFIRMATION DRIVING PATTERN



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1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine and idle it for 5 minutes or more [B].
8. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of 2500 rpm for 1 minute [C].
9. Idle the engine for 5 minutes or more [D].
10. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
11. Read the DTC [E].
12. If a DTC is output, the system is malfunctioning.

HINT:

If a DTC is not output, perform the following procedure.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Input the DTC: P0031, P0032, or P101D.
15. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform step [B] through [D] again.

16. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
17. Check the judgment result.

HINT:

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- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

18. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P2195 INFO.

INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)

*1



(a) Disconnect the air fuel ratio sensor connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

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Tester Connection	Condition	Specified Condition
1 (HA1A) - 2 (+B)	20°C (68°F)	1.8 to 3.4 Ω
1 (HA1A) - 4 (A1A-)	Always	10 kΩ or higher

Text in Illustration

*1	Component without harness connected (to Air Fuel Ratio Sensor)

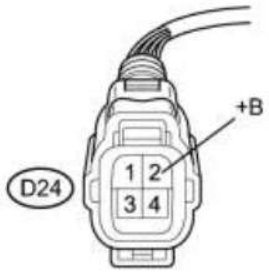
(c) Reconnect the air fuel ratio sensor connector.

NG ▶ REPLACE AIR FUEL RATIO SENSOR

OK ▼

2.	CHECK TERMINAL VOLTAGE (POWER SOURCE)

*1



(a) Disconnect the air fuel ratio sensor connector.

c

(b) Turn the power switch on (IG).

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
D24-2 (+B) - Body ground	Power switch on (IG)	11 to 14 V

Text in Illustration

*1	Front view of wire harness connector (to Air Fuel Ratio Sensor)

(d) Reconnect the air fuel ratio sensor connector.

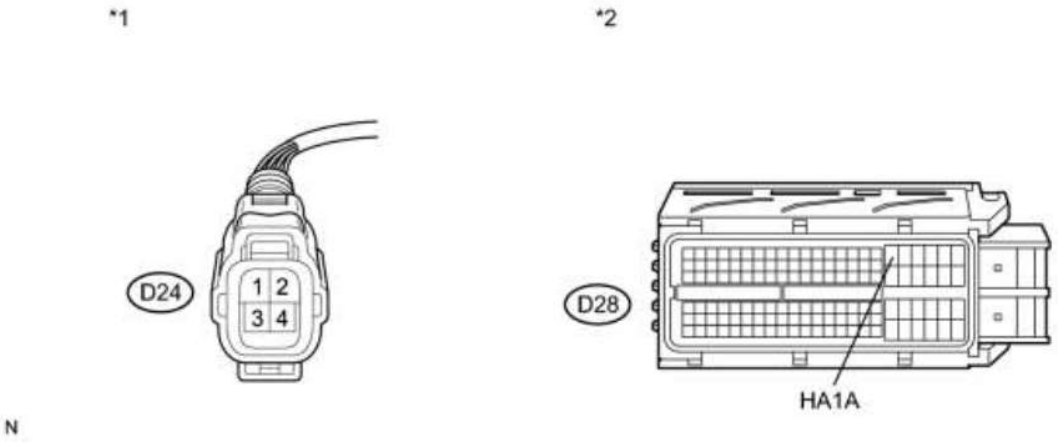
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NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (AIR FUEL RATIO SENSOR - EFI MAIN RELAY)

OK ▼

3.	CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - ECM)

(a) Disconnect the air fuel ratio sensor connector.



(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D24-1 (HA1A) - D28-18 (HA1A)	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D24-1 (HA1A) or D28-18 (HA1A) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Air Fuel Ratio Sensor)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the air fuel ratio sensor connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (AIR FUEL RATIO SENSOR - ECM)

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OK

4.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0031 OR P0032)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Put the engine in inspection mode INFO.

(f) Start the engine.

(g) Allow the engine to idle for 5 minutes or more.

(h) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(i) Read the DTCs.

Result:

Result	Proceed to
DTC is not output	A
DTC P0031, P0032 or P101D is output	B

B REPLACE ECM

A **CHECK FOR INTERMITTENT PROBLEMS**

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DTC	P0037	Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 2)
DTC	P0038	Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 2)
DTC	P0141	Oxygen Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)
DTC	P102D	O2 Sensor Heater Circuit Performance Bank 1 Sensor 2 Stuck ON

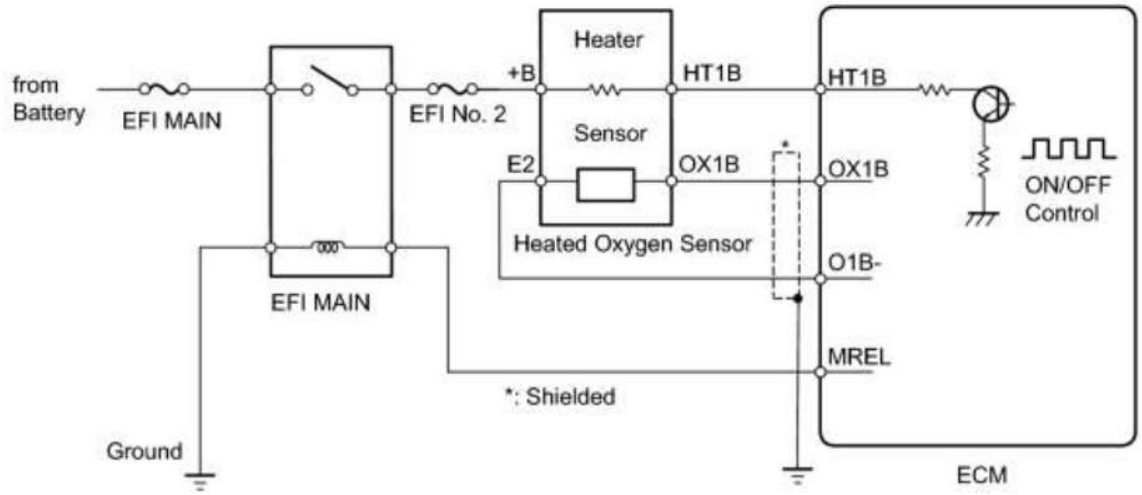
DESCRIPTION

Refer to DTC P0136 INFO.

HINT:

- Sensor 2 refers to the sensor mounted behind the three-way catalytic converter and located far from the engine assembly.
- When any of these DTCs are set, the ECM enters fail-safe mode. The ECM turns off the heated oxygen sensor heater in fail-safe mode. Fail-safe mode continues until the power switch is turned off.
- The ECM uses pulse width modulation to adjust the current through the heater. The heated oxygen sensor heater circuit uses a relay on the +B side of the circuit.

Reference (System Diagram of Sensor 2):



DTC No.	DTC Detection Condition	Trouble Area
P0037	The heater current less than the specified value while the heater is operating (1 trip detection logic).	• Open in heated oxygen sensor (sensor 2) heater circuit • Heated oxygen sensor (sensor 2) heater • ECM
P0038	The heater current is higher than the specified value while the heater is operating (1 trip detection logic).	• Short in heated oxygen sensor (sensor 2) heater circuit • Heated oxygen sensor (sensor 2) heater

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DTC No.	DTC Detection Condition	Trouble Area
		• ECM
P0141	The cumulative heater resistance correction value exceeds the threshold (2 trip detection logic).	• Open or short in heated oxygen sensor (sensor 2) heater circuit • Heated oxygen sensor (sensor 2) heater • ECM
P102D	The heater current is higher than the specified value while the heater is not operating (1 trip detection logic).	ECM

HINT:

- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.

MONITOR DESCRIPTION

The sensing portion of the heated oxygen sensor has a zirconia element which is used to detect the oxygen concentration in the exhaust gas. If the zirconia element is at the appropriate temperature, and the difference between the oxygen concentrations surrounding the inside and outside surfaces of the sensor is large, the zirconia element generates voltage signals. In order to increase the oxygen concentration detecting capacity of the zirconia element, the ECM supplements the heat from the exhaust with heat from a heating element inside the sensor.

Heated Oxygen Sensor Heater Range Check (P0037, P0038 and P102D):

• The ECM monitors the current applied to the heated oxygen sensor heater to check the heater for malfunctions.

If the heater current is outside the normal range, the signal transmitted by the heated oxygen sensor becomes inaccurate. When the current in the heated oxygen sensor heater is outside the normal operating range, the ECM interprets this as a malfunction in the sensor heater and stores a DTC.

Heated Oxygen Sensor Heater Performance (P0141):

• After the accumulated heater ON time exceeds 100 seconds, the ECM calculates the heater resistance using battery voltage and the current applied to the heater. If the resistance is above the threshold value, the ECM determines that there is a malfunction in the heated oxygen sensor heater and stores DTC P0141.

MONITOR STRATEGY

Related DTCs	P0037: Heated oxygen sensor heater (sensor 2) open/short (Low

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	electrical current) P0038: Heated oxygen sensor heater (sensor 2) open/short (High electrical current) P0141: Heated oxygen sensor heater performance (sensor 2) P102D: Heated oxygen sensor heater ON stuck (sensor 2)
Required sensors/Components (Main)	Heated oxygen sensor heater (sensor 2)
Required sensors/Components (Related)	-
Frequency of operation	Continuous: P0037, P0038, P102D Once per driving cycle: P0141
Duration	0.5 seconds: P0037, P102D 1 second: P0038 10 seconds: P0141
MIL operation	Immediately: P0037, P0038, P102D 2 driving cycles: P0141
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not present	None

P0037 (Case 1)

Battery voltage	10.5 V or more
Engine	Running
Starter	OFF
Catalyst active air fuel ratio control	Not operating
Time after heater ON	10 seconds or more
Learned heater OFF current operation	Complete
Heater OFF current learned value	Acquired
Heated oxygen sensor heater high current fail (P0038)	Not detected

P0037 (Case 2)

Battery voltage	10.5 V or more

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Time after heater ON	10 seconds or more
Learned heater OFF current operation	Complete
Heated oxygen sensor heater OFF current	More than 3.5 A
Hybrid IC high current limiter port	Fail
Heated oxygen sensor heater high current fail (P0038)	Not detected

P0038

Battery voltage	10.5 V or more
Engine	Running
Starter	OFF
Catalyst active air fuel ratio control	Not operating
Time after heater ON	10 seconds or more
Learned heater OFF current operation	Complete

P0141 (Case 1)

Heated oxygen sensor heater circuit fail (P0037 and P0038)	Not detected
Battery voltage	10.5 V or more
Fuel cut	OFF
Time after fuel cut ON to OFF	30 seconds or more
Accumulated heater ON time	100 seconds or more
Learned heater OFF current operation	Complete

P0141 (Case 2)

Duration that rear heated oxygen sensor impedance is less than 15 kΩ	2 seconds or more

P102D

Battery voltage	10.5 V or more
Time after heater ON	10 seconds or more
Learned heater OFF current operation	Complete
Heated oxygen sensor heater OFF current	More than 3.5 A
Hybrid IC high current limiter port	Fail
Heated oxygen sensor heater high current fail (P0038)	Not detected

TYPICAL MALFUNCTION THRESHOLDS

P0037 (Case 1)

Heater ON current - Learned heater OFF current	0.3 A or less

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P0037 (Case 2)

Heated oxygen sensor heater ON current	1 A or less

P0038

Hybrid IC high current limiter port	Fail
Heated oxygen sensor heater output	ON

P0141

Accumulated heater resistance	Varies with sensor element temperature (Example: Higher than 23 Ω)

P102D

Heated oxygen sensor heater ON current	Higher than 1 A

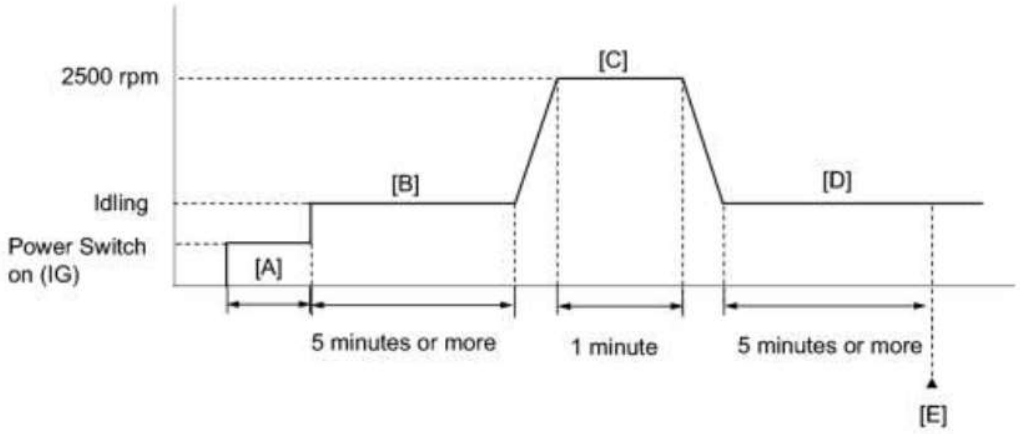
COMPONENT OPERATING RANGE

Heated oxygen sensor heater current	0.4 to 1 A (when engine idles, heated oxygen sensor warmed up and battery voltage 11 to 14 V)

MONITOR RESULT

- Refer to Checking Monitor Status INFO.

CONFIRMATION DRIVING PATTERN



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1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine and idle it for 5 minutes or more [B].
8. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of 2500 rpm for 1 minute [C].
9. Idle the engine for 5 minutes or more [D].
10. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
11. Read the pending DTC [E].
12. If a pending DTC is output, the system is malfunctioning.

HINT:

If a pending DTC is not output, perform the following procedure.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Input the DTC: P0037, P0038, P0141, or P102D.
15. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform step [B] through [D] again.

16. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
17. Check the judgment result.

HINT:

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- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

18. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0136 INFO.

INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

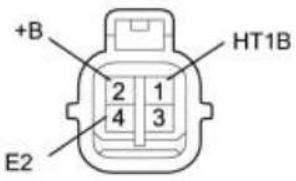
HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	INSPECT HEATED OXYGEN SENSOR (HEATER RESISTANCE)

*1



(a) Disconnect the heated oxygen sensor connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

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Tester Connection	Condition	Specified Condition
1 (HT1B) - 2 (+B)	20°C (68°F)	11 to 16 Ω
1 (HT1B) - 4 (E2)	Always	10 kΩ or higher

Text in Illustration

*1	Component without harness connected (Heated Oxygen Sensor (Sensor 2))

(c) Reconnect the heated oxygen sensor connector.

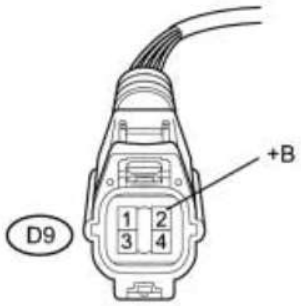
NG ▶ REPLACE HEATED OXYGEN SENSOR

OK

▼

2.	CHECK TERMINAL VOLTAGE (POWER SOURCE)

*1



(a) Disconnect the heated oxygen sensor connector.

(b) Turn the power switch on (IG).

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
D9-2 (+B) - Body ground	Power switch on (IG)	11 to 14 V

Text in Illustration

*1	Front view of harness connector (to Heated Oxygen Sensor (Sensor 2))

(d) Reconnect the heated oxygen sensor connector.

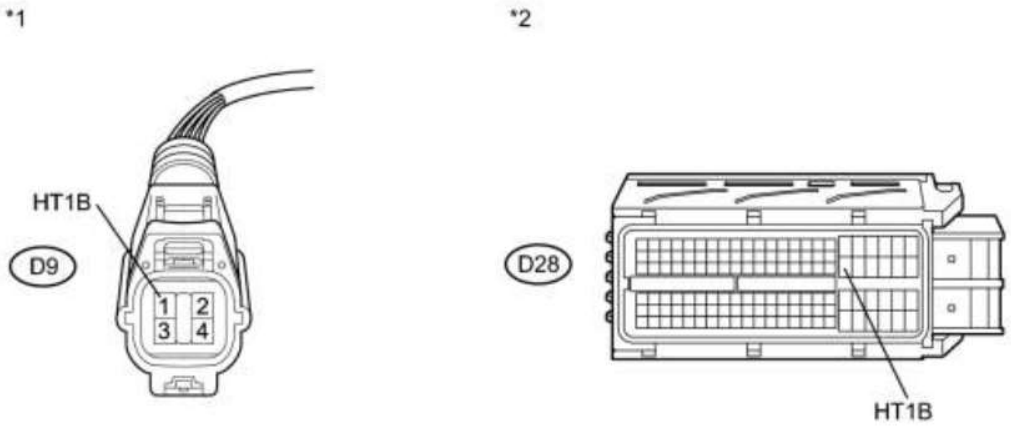
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NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (HEATED OXYGEN SENSOR - EFI MAIN RELAY)

OK ▼

3.	CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR - ECM)

(a) Disconnect the heated oxygen sensor connector.



(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D9-1 (HT1B) - D28-41 (HT1B)	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D9-1 (HT1B) or D28-41 (HT1B) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of harness connector (to Heated Oxygen Sensor (Sensor 2))	*2	Front view of harness connector (to ECM)

(d) Reconnect the heated oxygen sensor connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (HEATED OXYGEN SENSOR - ECM)

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OK

4.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0037, P0038, P0141 OR P0101D)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Put the engine in inspection mode INFO.

(f) Start the engine.

(g) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(h) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(i) Read the pending DTCs.

Result:

Result	Proceed to
DTC is not output	A
DTC P0037, P0038, P0141 or P102D is output	B

B REPLACE ECM

A **CHECK FOR INTERMITTENT PROBLEMS**

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DTC	P0101	Mass Air Flow Circuit Range / Performance Problem

DESCRIPTION

Refer to DTC P0102 INFO.

DTC No.	DTC Detection Condition	Trouble Area
P0101	Conditions (a), (b), (c), (d) and (e) continue for more than 10 seconds (2 trip detection logic): (a) Engine running (b) Engine coolant temperature 70°C (158°F) or higher (c) Throttle position sensor voltage 0.2 to 2 V (d) Average engine load value ratio less than 0.829, or more than 1.153 (varies with estimated engine load) Average engine load value ratio = Average engine load based on mass air flow meter output / Average engine load estimated from driving conditions (e) Average air fuel ratio less than -20%, or more than 20%	• Mass air flow meter sub-assembly • Intake system • PCV hose connections • EGR valve assembly

MONITOR DESCRIPTION

The mass air flow meter sub-assembly is a sensor that measures the amount of air flowing through the throttle valve. The ECM uses this information to determine the fuel injection time and to provide an appropriate air fuel ratio. Inside the mass air flow meter sub-assembly, there is a heated platinum wire which is exposed to the flow of intake air. By applying a specific electrical current to the wire, the ECM heats it to a specific temperature. The flow of incoming air cools both the wire and an internal thermistor, affecting their resistance. To maintain a constant current value, the ECM varies the voltage applied to the mass air flow meter sub-assembly. The voltage level is proportional to the air flow through the sensor, and the ECM uses it to calculate the intake air volume.

The ECM monitors the average engine load value ratio to check the mass air flow meter sub-assembly for malfunctions. The average engine load value ratio is obtained by comparing the average engine load calculated from the mass air flow meter sub-assembly output to the average engine load estimated from the driving conditions, such as the engine speed and the throttle opening angle. If the average engine load value ratio is below the threshold value, the ECM determines that the intake air volume is low, and if the average engine load value ratio is above the threshold value, the ECM determines that the intake air volume is high.

If this is detected in 2 consecutive driving cycles, the MIL is illuminated and the DTC is set.

MONITOR STRATEGY

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Related DTCs	P0101: Mass air flow meter rationality
Required Sensors/Components (Main)	Mass air flow meter sub-assembly
Required Sensors/Components (Related)	Crankshaft position sensor Camshaft position sensor Engine coolant temperature sensor Throttle position sensor
Frequency of Operation	Continuous
Duration	10 times
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
Time after engine starts	5 seconds or more
Battery voltage	10.5 V or more
Throttle position (Throttle position sensor voltage)	0.2 to 2 V
Estimated Load	30 to 70%
Engine coolant temperature	70°C (158°F) or more
Mass air flow meter circuit (P0102, P0103)	OK
Intake air temperature sensor circuit (P0112, P0113)	OK
Engine coolant temperature sensor circuit (P0115, P0117, P0118)	OK
Crankshaft position sensor circuit (P0335)	OK
Throttle position sensor circuit (P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135)	OK
EVAP system pressure sensor circuit (P0452, P0453)	OK
EVAP leak detection pump (P2401, P2402)	OK
EVAP system vent valve (P2419, P2420)	OK

TYPICAL MALFUNCTION THRESHOLDS

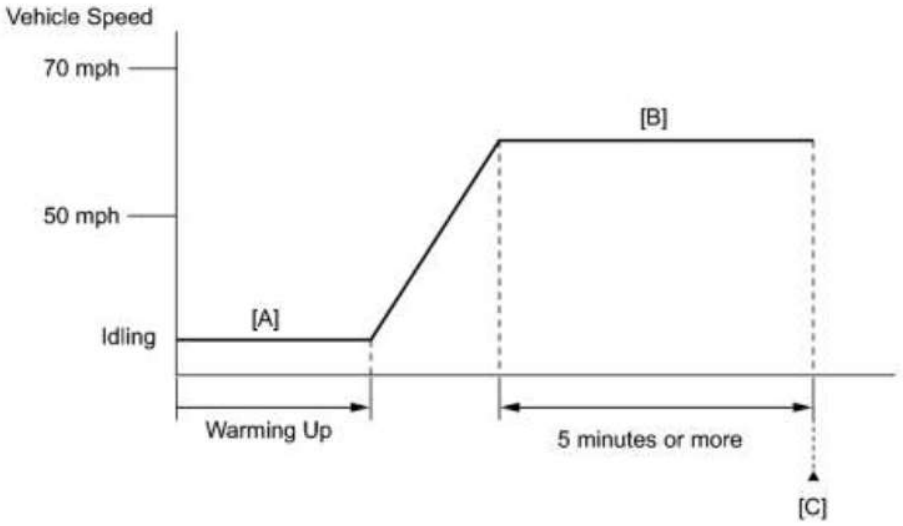
Both of the following conditions 1 and 2 are met	-
1. Averaged engine load value ratio	Less than 0.829, or more than 1.153 (varies with estimated engine load)
2. Averaged air fuel ratio	Less than -20%, or more than 20%

WIRING DIAGRAM

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Refer to DTC P0102 INFO.

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG).
3. Turn the Techstream on.
4. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
5. Turn the power switch off and wait for 30 seconds.
6. Turn the power switch on (IG) and turn the Techstream on.
7. Put the engine in inspection mode INFO.
8. Start the engine and warm it up until the engine coolant temperature reaches 70°C (158°F) or higher [A].
9. Drive the vehicle at approximately 50 mph (80 km/h) to 70 mph (112 km/h) for 5 minutes or more [B].

   HINT:

   Drive while keeping the engine load as stable as possible.

10. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
11. Read the pending DTC [C].
12. If a pending DTC is output, the system is malfunctioning.

    HINT:

    If a pending DTC is not output, perform the following procedure.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Input the DTC: P0101.
15. Check the DTC judgment result.

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Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform step [B] again.

16. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
17. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

18. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

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PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0101)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result:

Result	Proceed to
DTC P0101 is output	A
DTC P0101 and other DTCs are output	B

HINT:

If any DTCs other than P0101 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO.

OK:

No leaks from the intake system.

NG ▶ REPAIR OR REPLACE INTAKE SYSTEM

OK ▼

3.	CHECK PCV HOSE CONNECTIONS

(a) Check the PCV hose connections.

OK:

PCV hose is connected correctly and is not damaged.

NG ▶ REPAIR OR REPLACE PCV HOSE

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OK

4.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	**0 to 30 Steps**
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

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Result:

Result	Proceed to
Outside of standard range	A
Within standard range	B

B ▶ REPLACE MASS AIR FLOW METER SUB-ASSEMBLY

A ▼

5.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

NG ▶ REPLACE EGR VALVE ASSEMBLY

OK ▼

6.	REPLACE MASS AIR FLOW METER SUB-ASSEMBLY

(a) Replace the mass air flow meter sub-assembly INFO.

NEXT ▼

7.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTC INFO.

(e) Turn the power switch off and wait for 30 seconds.

(f) Turn the power switch on (IG) and turn the Techstream on.

(g) Put the engine in inspection mode INFO.

(h) Start the engine and warm it up.

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(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(k) Input the DTC: P0101.

(l) Check the DTC judgment result.

NEXT ▶ **END**

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DTC	P0102	Mass or Volume Air Flow Circuit Low Input
DTC	P0103	Mass or Volume Air Flow Circuit High Input

DESCRIPTION

The mass air flow meter sub-assembly is a sensor that measures the amount of air flowing through the throttle valve.

The ECM uses this information to determine the fuel injection time and to provide the appropriate air fuel ratio.

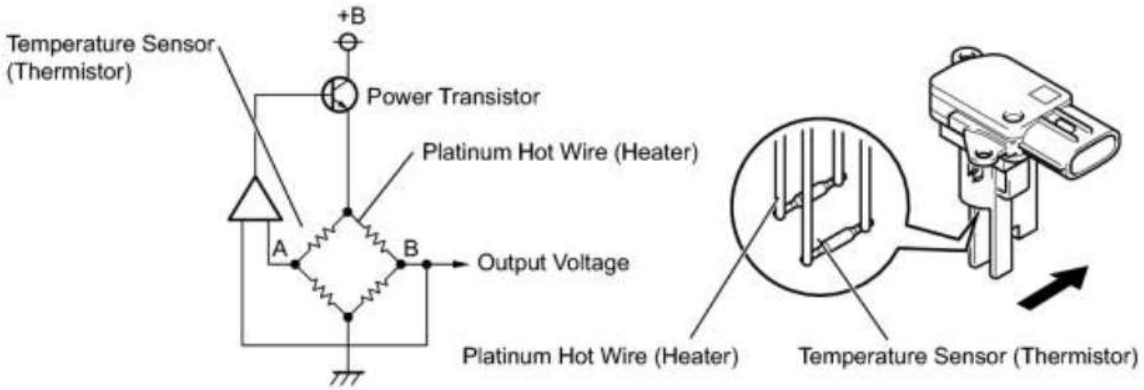
Inside the mass air flow meter sub-assembly, there is a heated platinum wire which is exposed to the flow of intake air by applying a specific electrical current to the wire.

The flow of incoming air cools both the wire and an internal thermistor, affecting their resistance. To maintain a constant temperature value of the hot wire, current is applied to these components in the mass air flow meter sub-assembly. The voltage level is proportional to the airflow through the sensor, and the ECM uses it to calculate the intake air volume.

The circuit is constructed so that the platinum hot wire and the temperature sensor create a bridge circuit, and the power transistor is controlled so that the potentials of A and B remain equal to maintain the predetermined temperature.

HINT:

When either of these DTCs are set, the ECM enters fail-safe mode. During fail-safe mode, the ignition timing is calculated by the ECM, according to the engine speed and throttle valve position. Fail-safe mode continues until a pass condition is detected.



DTC No.	DTC Detection Condition	Trouble Area
P0102	Mass air flow meter voltage less than 0.2 V for 3 seconds (1 trip detection logic)	• Open or short in mass air flow meter sub-assembly circuit • Mass air flow meter sub-assembly • ECM

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DTC No.	DTC Detection Condition	Trouble Area
P0103	Mass air flow meter voltage more than 4.9 V for 3 seconds (1 trip detection logic)	• Open or short in mass air flow meter sub-assembly circuit • Mass air flow meter sub-assembly • ECM

HINT:

When any of these DTCs are set, check the air-flow rate by entering the following menus: Powertrain / Engine and ECT / Data List / MAF.

Mass Air Flow Rate (gm/sec)	Malfunction
Approximately 0.0	• Open in mass air flow meter sub-assembly power source circuit • Open or short in VG circuit
271.0 or more	Open in E2G circuit

MONITOR DESCRIPTION

If there is a defect in the mass air flow meter sub-assembly or an open or short circuit, the voltage level deviates from the normal operating range. The ECM interprets this deviation as a malfunction in the mass air flow meter sub-assembly circuit and sets a DTC.

Example:

When the sensor output voltage remains less than 0.2 V, or more than 4.9 V, for more than 3 seconds, the ECM sets a DTC.

If the malfunction is not repaired successfully, a DTC is set 3 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0102: Mass air flow meter range check (Low voltage) P0103: Mass air flow meter range check (High voltage)
Required Sensors/Components (Main)	Mass air flow meter sub-assembly
Required Sensors/Components (Related)	Crankshaft position sensor Throttle position sensor
Frequency of Operation	Continuous
Duration	3 seconds
MIL Operation	Immediately: Engine speed less than 4000 rpm 2 driving cycles: Engine speed 4000 rpm or more

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Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None

TYPICAL MALFUNCTION THRESHOLDS

P0102:

Mass air flow meter voltage	Less than 0.2 V

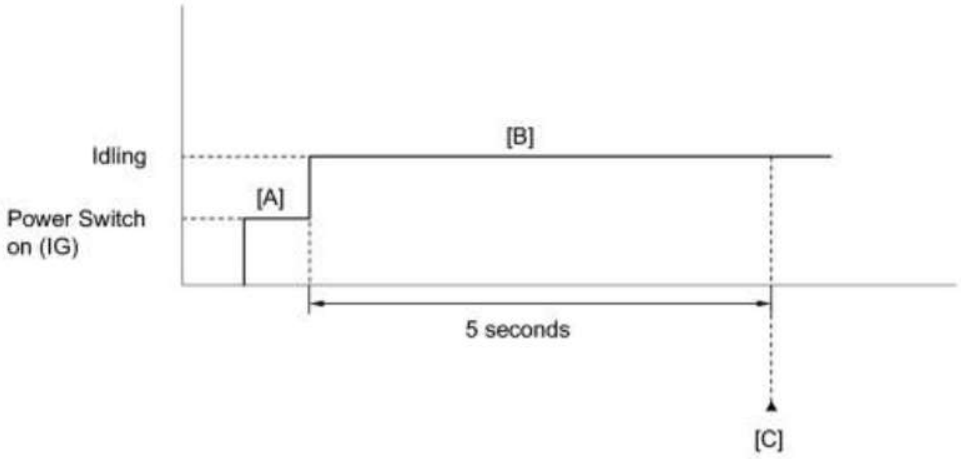
P0103:

Mass air flow meter voltage	More than 4.9 V

COMPONENT OPERATING RANGE

Mass air flow meter voltage	Between 0.2 V and 4.9 V

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].

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6. Put the engine in inspection mode INFO.
7. Start the engine.
8. Idle the engine for 5 seconds [B].
9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
10. Read the DTC [C].
11. If a DTC is output, the system is malfunctioning.

HINT:

If a DTC is not output, perform the following procedure.

12. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
13. Input the DTC: P0102 or P0103.
14. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

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HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform step [B] again.

15. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
16. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

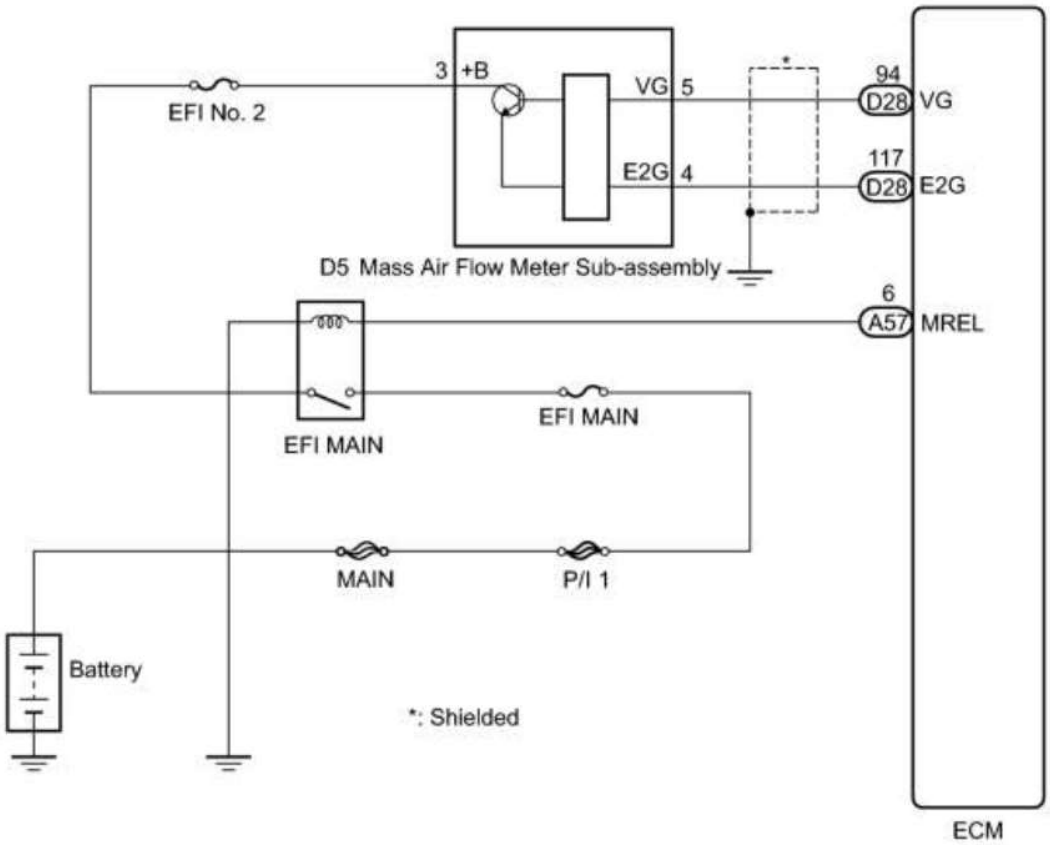
17. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.

- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



c

INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	READ DTC OUTPUT

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(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result:

Result	Proceed to
DTC P0102 is output	A
DTC P0103 is output	B

B ▶ CHECK HARNESS AND CONNECTOR (SENSOR GROUND)

A ▼

2.	INSPECT MASS AIR FLOW METER SUB-ASSEMBLY (POWER SOURCE VOLTAGE)

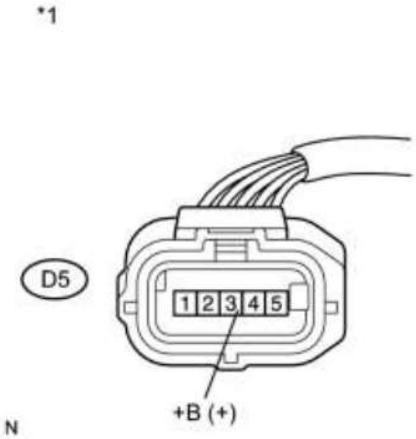
(a) Disconnect the mass air flow meter sub-assembly connector.

(b) Turn the power switch on (IG).

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
D5-3 (+B) - Body ground	Power switch on (IG)	11 to 14 V



Text in Illustration

*1	Front view of wire harness connector (to Mass Air Flow Meter Sub-assembly)

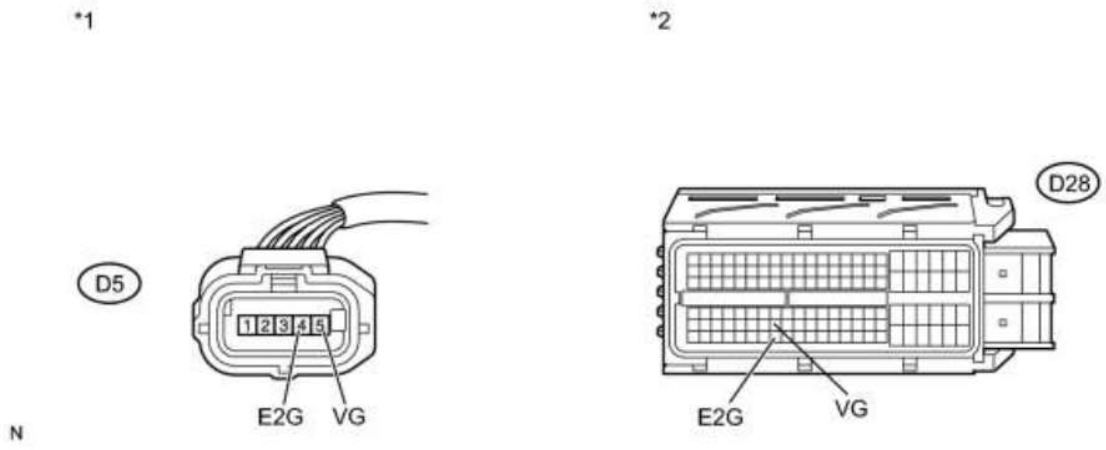
(d) Reconnect the mass air flow meter sub-assembly connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (EFI MAIN RELAY - MASS AIR FLOW METER SUB-ASSEMBLY)

OK ▼

3.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER SUB-ASSEMBLY - ECM)

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(a) Disconnect the mass air flow meter sub-assembly connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D5-5 (VG) - D28-94 (VG)	Always	Below 1 Ω
D5-4 (E2G) - D28-117 (E2G)		

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D5-5 (VG) or D28-94 (VG) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Mass Air Flow Meter Sub-assembly)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the mass air flow meter sub-assembly connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (MASS AIR FLOW METER SUB-ASSEMBLY - ECM)

OK ▼

4.	INSPECT MASS AIR FLOW METER SUB-ASSEMBLY

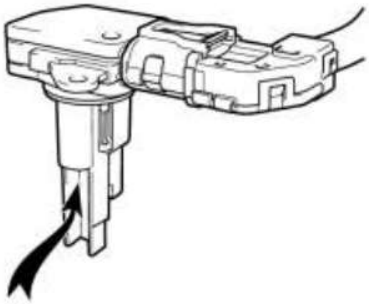
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(a) Perform On-vehicle inspection INFO.

(b) Perform Inspection INFO.

(c) Inspect the function of the mass air flow meter sub-assembly.

(1) Remove the mass air flow meter sub-assembly with the connector connected.



P

(2) Connect the Techstream to the DLC3.

(3) Turn the power switch on (IG).

(4) Turn the Techstream on.

(5) Enter the following menus: Powertrain / Engine and ECT / Data List / MAF.

(6) Blow air to the mass air flow meter sub-assembly and check that the intake air amount reading changes.

OK:

The reading changes.

NG ▶ REPLACE MASS AIR FLOW METER SUB-ASSEMBLY
OK ▶ **REPLACE ECM**

5.	CHECK HARNESS AND CONNECTOR (SENSOR GROUND)

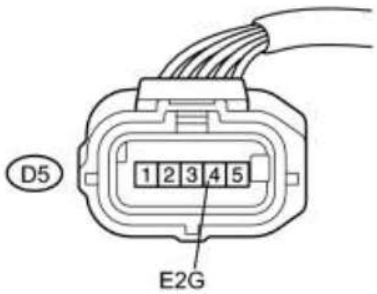
(a) Disconnect the mass air flow meter meter sub-assembly connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

*1

Tester Connection	Condition	Specified Condition
D5-4 (E2G) - Body ground	Always	Below 1 Ω



N

Text in Illustration

*1	Front view of wire harness connector (to Mass Air Flow Meter Sub-assembly)

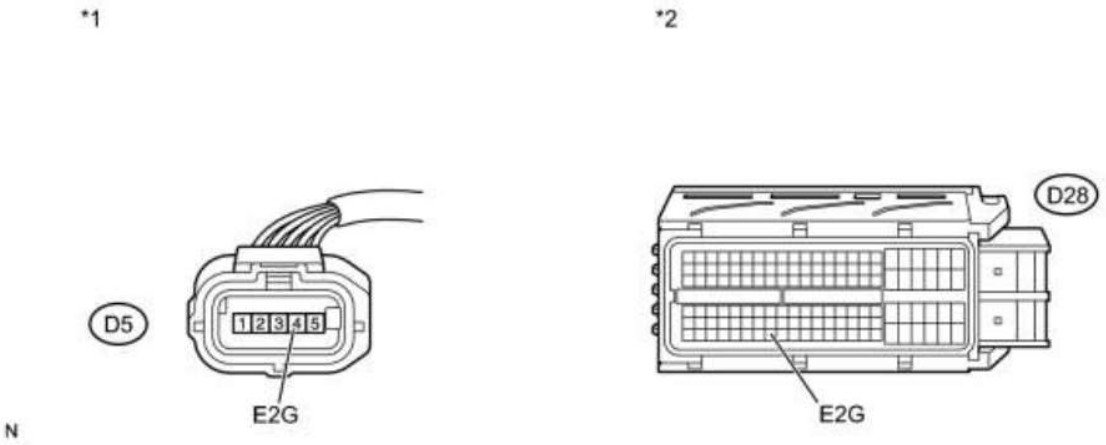
(c) Reconnect the mass air flow meter sub-assembly connector.

NG ▶ CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER SUB-ASSEMBLY - ECM)
OK ▶ **REPLACE MASS AIR FLOW METER SUB-ASSEMBLY**

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6.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER SUB-ASSEMBLY - ECM)

(a) Disconnect the mass air flow meter sub-assembly connector.



(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D5-4 (E2G) - D28-117 (E2G)	Always	Below 1 Ω

Text in Illustration

*1	Front view of wire harness connector (to Mass Air Flow Meter Sub-assembly)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the mass air flow meter sub-assembly connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (MASS AIR FLOW METER SUB-ASSEMBLY - ECM)

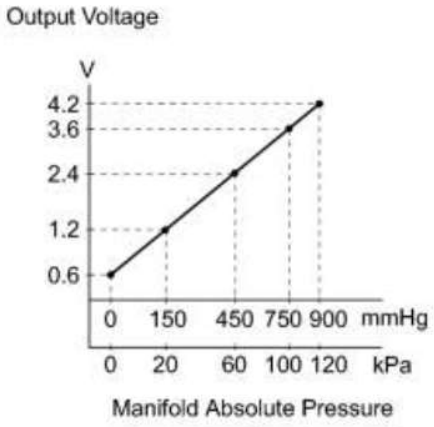
OK ▶ **REPLACE ECM**

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DTC	P0106	Manifold Absolute Pressure / Barometric Pressure Circuit Range / Performance Problem

DESCRIPTION

The manifold absolute pressure sensor detects pressure inside the intake manifold as an absolute pressure with a built-in sensor and outputs a voltage. Based on the voltage from the manifold absolute pressure sensor, the ECM controls the EGR, purge VSV, and detects errors in the pressure sensor using the changes in pressure.



DTC No.	DTC Detection Condition	Trouble Area
P0106	Difference between the intake manifold pressures after and before the engine start remains more than -3kPa (-22.5 mmHg) for 6 seconds or more (2 trip detection logic).	• Intake system • Manifold absolute pressure sensor

MONITOR DESCRIPTION

The manifold absolute pressure sensor detects the intake manifold pressure as a voltage using a built-in sensor. The ECM calculates intake manifold pressure based on this voltage and also calculates the EGR valve and purge VSV opening amount according to changes in the intake manifold pressure. When the atmospheric pressure drops below the intake manifold pressure by 3 kPa (22.5 mmHg) or more, the ECM interprets this as a malfunction in the manifold absolute pressure sensor and sets P0106.

MONITOR STRATEGY

Related DTCs	P0106: Manifold absolute pressure sensor stuck
Required Sensor/Components (Main)	Manifold absolute pressure sensor
Required Sensor/Components (Related)	-
Frequency of Operation	Continuous
Duration	6 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

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TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	P0010 (Camshaft timing oil control valve assembly Bank 1) P0011 (VVT System Bank 1 - Advance) P0012 (VVT System Bank 1 - Retard) P0016 (VVT System Bank 1 - Misalignment) P0107, P0108 (Manifold Absolute Pressure) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0335 (Crankshaft Position Sensor) P0401 (EGR System (Closed)) P106A (Evaporative Emission Control System Pressure Sensor - Manifold Pressure Sensor Correlation)
Battery voltage	10.5 V or more
Engine coolant temperature	30°C (86°F) or more
Intake air temperature	-10°C (14°F) or more
Engine speed	1000 rpm or more
Throttle position	Less than 2°
EGR active open for repair	Not activated
EGR duty	20 steps or more
Atmospheric pressure	76 kPa (570 mmHg) or more

TYPICAL MALFUNCTION THRESHOLDS

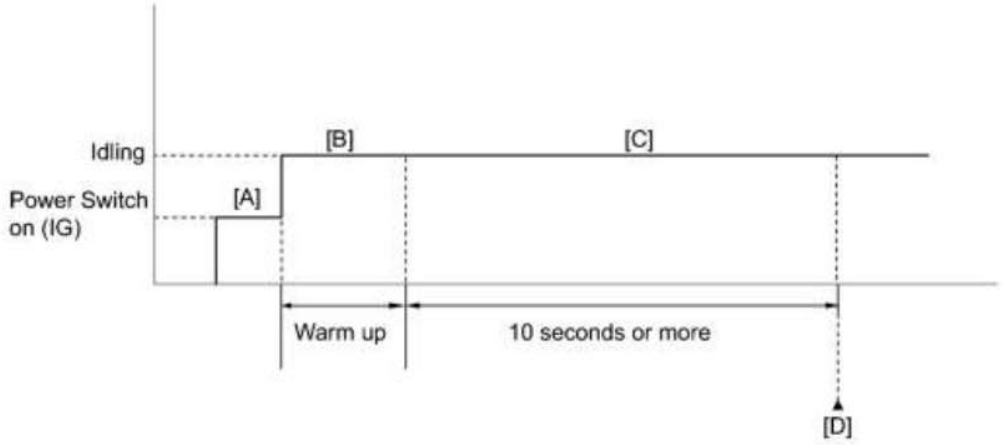
Difference between manifold absolute pressure sensor and atmospheric pressure	More than -3 kPa (-22.5 mmHg)

COMPONENT OPERATING RANGE

Difference between manifold absolute pressure sensor and atmospheric pressure	-3 kPa (-22.5 mmHg) or less

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CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine and warm it up (until the engine coolant temperature is 75°C (167°F) or higher) [B].
8. Move the shift lever to N.
9. Idle the engine for 10 seconds or more [C].
10. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
11. Read Pending DTC [D].
12. If the pending DTC is output, the system is malfunctioning.

    HINT:

    If a pending DTC is not output, perform the following procedure.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Input the DTC: P0106.
15. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed

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Techstream Display	Description
	○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform step [C] again.

16. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
17. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

18. If the test result is INCOMPLETE or UNKNOWN, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	CHECK ANY OTHER DTC OUTPUT (IN ADDITION TO P0106)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG) and turn the Techstream on.

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(c) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(d) Read the DTCs.

Result

Result	Proceed to
DTC P0106 is output	A
DTC P0106 and other DTCs are output	B

HINT:

If any DTCs other than P0106 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	READ VALUE USING TECHSTREAM (MANIFOLD ABSOLUTE PRESSURE SENSOR)

(a) Connect the Techstream to the DLC3.

(b) Put the engine in inspection mode INFO.

(c) Start the engine and warm it up.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / MAP.

(f) Read the MAP value at idling and 2500 rpm.

Standard:

Engine condition	Tester Display
Power switch on (IG)	80 to 110 kPa
Idling	28 to 48 kPa
2500 rpm	22 to 50 kPa

NG ▶ CHECK INTAKE SYSTEM

OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

3.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO.

OK:

No leaks in the intake system.

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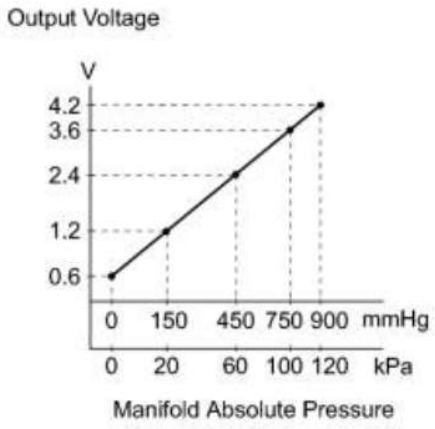
NG ▶ REPAIR OR REPLACE INTAKE SYSTEM
OK ▶ **REPLACE MANIFOLD ABSOLUTE PRESSURE SENSOR**

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DTC	P0107	Manifold Absolute Pressure / Barometric Pressure Circuit Low Input
DTC	P0108	Manifold Absolute Pressure / Barometric Pressure Circuit High Input

DESCRIPTION

The manifold absolute pressure sensor detects pressure inside the intake manifold as an absolute pressure with a built-in sensor and outputs a voltage. Based on the voltage from the vacuum sensor, the ECM controls the EGR, purge VSV, and corrects any errors in the pressure sensor due to changes in pressure.



DTC No.	DTC Detecting Condition	Trouble Area
P0107	The output voltage from the manifold absolute pressure sensor less than 0.5 V for 0.5 seconds. (1 trip detection logic)	• Open or short in manifold absolute pressure sensor circuit • Manifold absolute pressure sensor • ECM
P0108	The output voltage from the manifold absolute pressure sensor more than 4.5 V for 0.5 seconds. (1 trip detection logic)	• Open or short in manifold absolute pressure sensor circuit • Manifold absolute pressure sensor • ECM

HINT:

- DTC P0107 and P0108 are detected when the power switch is on (IG) for approximately 5 seconds.
- When DTC P0107 or P0108 is detected, check the manifold absolute pressure by selecting Powertrain / Engine and ECT / Data List / MAP on the Techstream.

Manifold Absolute Pressure (kPa)	Malfunction
Approximately 0	• PIM circuit short
130 or more	• VC circuit open or short • PIM circuit open • E2 circuit open

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Manifold Absolute Pressure (kPa)	Malfunction
	• ECM

MONITOR DESCRIPTION

The ECM monitors the sensor voltage and uses this value to calculate the manifold absolute pressure. When the sensor output voltage deviates from the normal operating range, the ECM interprets this as a malfunction in the manifold absolute pressure sensor and sets a DTC.

Example:

When the sensor output voltage remains less than 0.5 V, or more than 4.5 V for 0.5 seconds, the ECM sets a DTC.

If the malfunction is not repaired successfully, a DTC is set 0.5 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0107: Manifold absolute pressure sensor range check (Low voltage) P0108: Manifold absolute pressure sensor range check (High voltage)
Required Sensor/Components (Main)	Manifold absolute pressure sensor
Required Sensor/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.5 seconds
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
Starter	Off
Time after starter on to off	2 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

P0107

Manifold absolute pressure sensor voltage	Less than 0.5 V

P0108

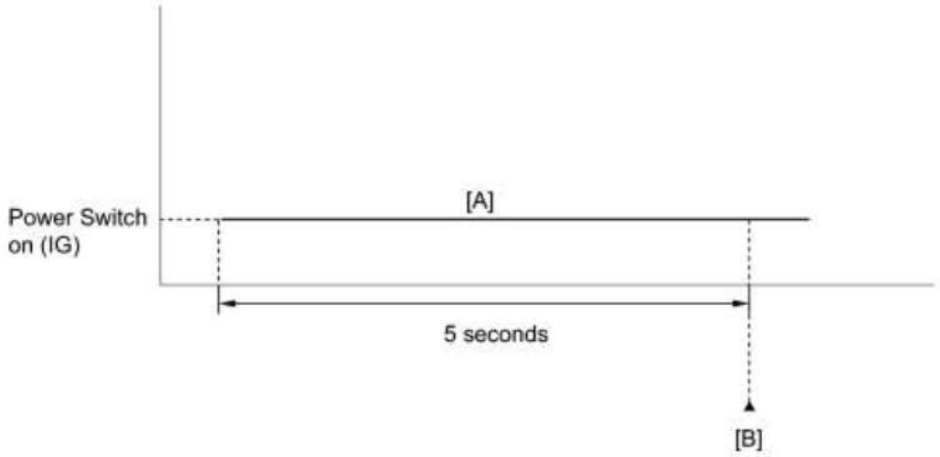
Manifold absolute pressure sensor voltage	More than 4.5 V

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COMPONENT OPERATING RANGE

Manifold absolute pressure sensor voltage	0.5 V or more, and 4.5 V or less

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Wait 5 seconds.
7. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
8. Read the DTC [B].
9. If a DTC is output, the system is malfunctioning.

   HINT:

   If a DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P0107 or P0108.
12. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal

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Techstream Display	Description
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform step [A] again.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

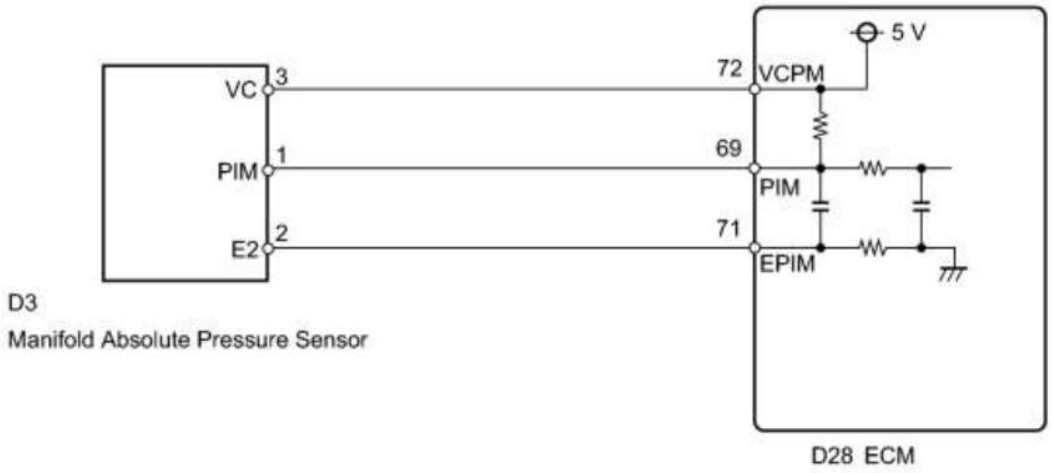
15. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	READ VALUE USING TECHSTREAM (MAP)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / MAP.

(e) Read the MAP value.

OK:

Same value as the actual atmospheric pressure.

HINT:

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- Standard atmospheric pressure is 101 kPa. For every 100 m (328 ft.) increase in altitude, pressure drops by 1 kPa. The pressure also varies due to the weather (high atmospheric pressure, low atmospheric pressure).
- Also, check "Atmosphere Pressure" in the Data List.

NG ▶ CHECK TERMINAL VOLTAGE (MANIFOLD ABSOLUTE PRESSURE SENSOR)
OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

2.	CHECK TERMINAL VOLTAGE (MANIFOLD ABSOLUTE PRESSURE SENSOR)

(a) Disconnect the manifold absolute pressure sensor connector.

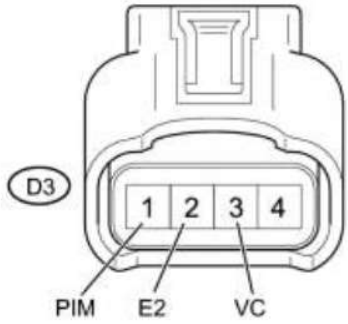
(b) Turn the power switch on (IG).

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
D3-3 (VC) - D3-2 (E2)	Power switch on (IG)	4.5 to 5.5 V
D3-1 (PIM) - D3-2 (E2)	Power switch on (IG)	4.0 to 5.0 V

*1



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Text in Illustration

*1	Front view of wire harness connector (to Manifold Absolute Pressure Sensor)

(d) Reconnect the manifold absolute pressure sensor connector.

Result:

Result	Proceed to
Outside standard range	A
Within standard range	B

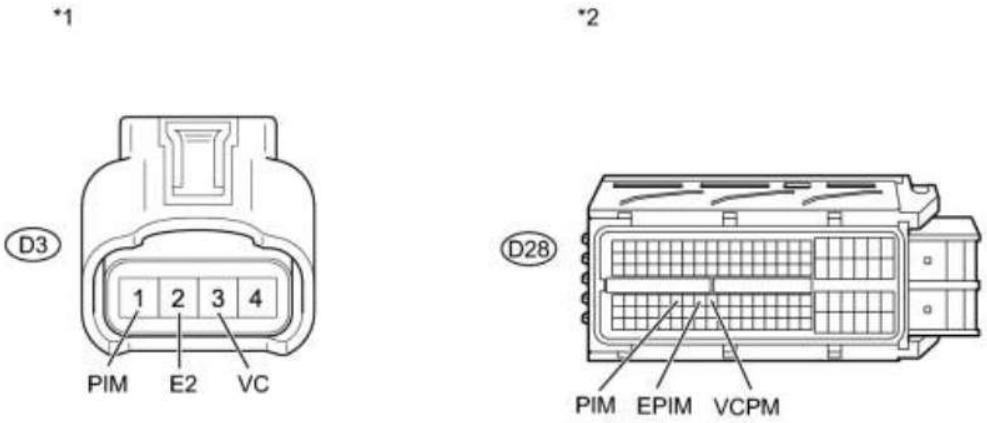
B ▶ REPLACE MANIFOLD ABSOLUTE PRESSURE SENSOR

A ▼

3.	CHECK HARNESS AND CONNECTOR (MANIFOLD ABSOLUTE PRESSURE SENSOR - ECM)

(a) Disconnect the manifold absolute pressure sensor connector.

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(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D3-3 (VC) - D28-72 (VCPM)	Always	Below 1 Ω
D3-2 (E2) - D28-71 (EPIM)		
D3-1 (PIM) - D28-69 (PIM)		

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D3-3 (VC) or D28-72 (VCPM) - Body ground	Always	10 kΩ or higher
D3-2 (E2) or D28-71 (EPIM) - Body ground		
D3-1 (PIM) or D28-69 (PIM) - Body ground		

Text in Illustration

*1	Front view of wire harness connector (to Manifold Absolute Pressure Sensor)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the manifold absolute pressure sensor connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (MANIFOLD ABSOLUTE PRESSURE SENSOR - ECM)

OK ▶ **REPLACE ECM**

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4.	REPLACE MANIFOLD ABSOLUTE PRESSURE SENSOR

(a) Replace the manifold absolute pressure sensor INFO.

NEXT

5.	CHECK WHETHER DTC OUTPUT RECURS (P0107 OR P0108)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG) and turn the Techstream on.

(c) Clear the DTC and turn the power switch off.

(d) Turn the power switch on (IG) and wait for 5 seconds.

(e) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(f) Read the DTCs.

Result:

Result	Proceed to
DTC is not output	A
DTC P0107 or P0108 is output	B

B ▶ REPLACE ECM

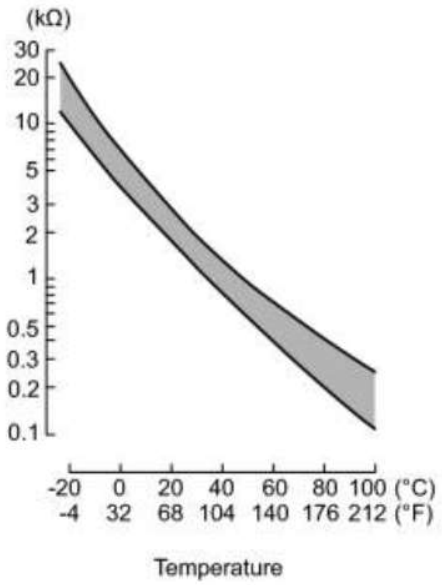
A ▶ **END**

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DTC	P0111	Intake Air Temperature Sensor Gradient Too High

DESCRIPTION

Fig. 1:



- The intake air temperature sensor, mounted in the mass air flow meter sub-assembly, monitors the intake air temperature. The intake air temperature sensor has a built-in thermistor with a resistance that varies according to the temperature of the intake air. When the intake air temperature becomes low, the resistance of the thermistor increases. When the temperature becomes high, the resistance drops. These variations in resistance are transmitted to the ECM as voltage changes (See Fig. 1).
- The intake air temperature sensor is powered by a 5 V supply from the THA terminal of the ECM, via resistor R which is located inside the ECM.
- Resistor R and the intake air temperature sensor are connected in series. When the resistance value of the intake air temperature sensor changes, according to changes in the intake air temperature, the voltage at terminal THA also varies. Based on this signal, the ECM increases the fuel injection volume when the engine is cold to improve driveability.

DTC No.	DTC Detection Condition	Trouble Area
P0111	When either of following conditions are met (2 trip detection logic): • In duration between engine warmed up and next engine starts, change in intake air temperature sensor output below threshold • During engine warming up after cold engine starts, change in intake air temperature sensor output bellow threshold	Mass air flow meter sub-assembly

MONITOR DESCRIPTION

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After warm engine stopped

The ECM monitors the intake air temperature variation in the period from when the engine was warmed up on the previous trip until the next engine start. If the change in the intake air temperature sensor output is less than the threshold, it is determined that a malfunction has occurred in the intake air temperature sensor. When this is detected, the MIL is illuminated and the DTC is set.

After a cold engine in started

The monitor runs when the engine is started cold after 5 hours or more have elapsed since the engine stopped. If the intake air temperature sensor output variation until the engine has warmed up completely is less than the threshold, it is determined that a malfunction has occurred in the intake air temperature sensor. When this is detected in 2 consecutive driving cycles, the MIL is illuminated and the DTC is set.

MONITOR STRATEGY

Related DTCs	P0111: Intake air temperature sensor rationality (After engine stop) P0111: Intake air temperature sensor rationality (After cold engine start)
Required Sensors/Components (Main)	Intake air temperature sensor
Required Sensors/Components (Sub)	-
Frequency of Operation	Once per driving cycle
Duration	5 hours or more
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not present	None

After Engine Stop

Time after engine start	10 seconds or more
Battery voltage	10.5 V or more
Intake air temperature circuit (P0112, P0113)	OK
Engine coolant temperature sensor circuit (P0115, P0117, P0118)	OK
Mass air flow meter circuit (P0102, P0103)	OK
Accumulated mass air flow amount before engine stop	3036 g or more
Key-off duration	30 minutes
Engine coolant temperature when 30 minutes elapsed after engine stop	-40°C (-40°F) or more

After Cold Engine Start

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Key-off duration	5 hours
Time after engine start	10 seconds or more
Intake air temperature circuit (P0112, P0113)	OK
Engine coolant temperature sensor circuit (P0115, P0117, P0118)	OK
Mass air flow meter circuit (P0102, P0103)	OK
Engine coolant temperature	70°C (158°F) or more
Accumulated mass air flow amount	3036 g or more
Either of the following conditions 1 or 2 is met:	-
1. Duration while engine load is low	120 seconds or more
2. Duration while engine load is high	10 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

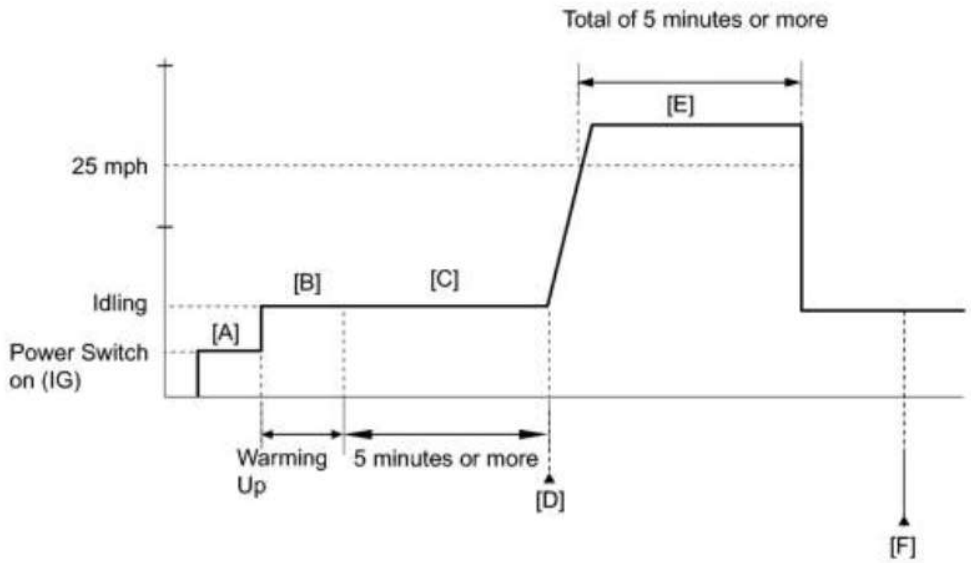
After Engine Stop

Intake air temperature change	Less than 1°C (1.8°F)

After Cold Engine Start

Intake air temperature change	Less than 1°C (1.8°F)

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.

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4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher [B].
8. Idle the engine for 5 minutes or more [C].

HINT:

During steps [A] through [C], if the change in the intake air temperature is below 1°C (2°F), the intake air temperature sensor (mass air flow meter sub-assembly) is malfunctioning. It is not necessary to continue this procedure.

9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
10. Read the pending DTC [D].
11. If a pending DTC is output, the system is malfunctioning.

HINT:

If a pending DTC is not output, perform the following procedure.

12. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
13. Input the DTC: P0111.
14. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [E] and [F].

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15. Drive the vehicle at 25 mph (40 km/h) or more for a total of 5 minutes or more [E].
16. Check the DTC judgment result again [F].
17. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
18. Check the judgment result.

    HINT:

    - If the judgment result shows ABNORMAL, the system has a malfunction.
    - If the judgment result shows NORMAL, the system is normal.

19. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0112 INFO.

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0111)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result:

Result	Proceed to
DTC P0111 and other DTCs are output	A
DTC P0111 is output	B

HINT:

If any DTCs other than P0111 are output, troubleshoot those DTCs first.

B REPLACE MASS AIR FLOW METER SUB-ASSEMBLY

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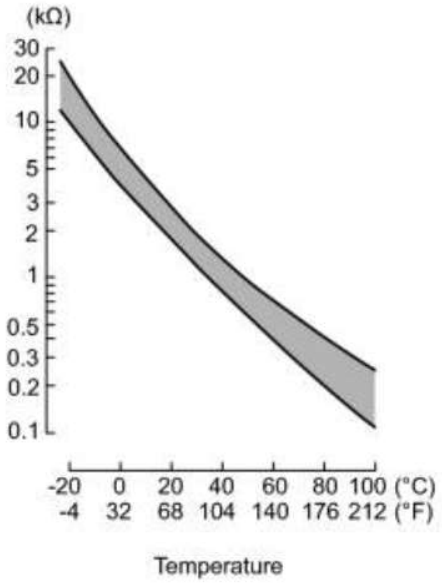
A ▶ GO TO DTC CHART

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DTC	P0112	Intake Air Temperature Circuit Low Input
DTC	P0113	Intake Air Temperature Circuit High Input

DESCRIPTION

Fig. 1:



- The intake air temperature sensor, mounted in the mass air flow meter sub-assembly, monitors the intake air temperature. The intake air temperature sensor has a built-in thermistor with a resistance that varies according to the temperature of the intake air. When the intake air temperature becomes low, the resistance of the thermistor increases. When the temperature becomes high, the resistance drops. These variations in resistance are transmitted to the ECM as voltage changes (see Fig. 1).
- The intake air temperature sensor is powered by a 5 V supply from the THA terminal of the ECM, via resistor R which is located inside the ECM.
- Resistor R and the intake air temperature sensor are connected in series. When the resistance value of the intake air temperature sensor changes, according to changes in the intake air temperature, the voltage at terminal THA also varies. Based on this signal, the ECM increases the fuel injection volume when the engine is cold to improve driveability.

HINT:

When either DTC P0112 or P0113 is set, the ECM enters fail-safe mode. During fail-safe mode, the intake air temperature is estimated to be 20°C (68°F) by the ECM. Fail-safe mode continues until a pass condition is detected.

DTC No.	DTC Detection Condition	Trouble Area

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DTC No.	DTC Detection Condition	Trouble Area
P0112	Short in intake air temperature sensor circuit for 0.5 seconds (1 trip detection logic)	• Short in intake air temperature sensor circuit • Intake air temperature sensor (built into mass air flow meter sub-assembly) • ECM
P0113	Open in intake air temperature sensor circuit for 0.5 seconds (1 trip detection logic)	• Open in intake air temperature sensor circuit • Intake air temperature sensor (built into mass air flow meter sub-assembly) • ECM

HINT:

When any of these DTCs are set, check the intake air temperature by entering the following menus: Powertrain / Engine and ECT / Intake Air.

Temperature Displayed	Malfunction
-40°C (-40°F)	Open circuit
140°C (284°F)	Short circuit

MONITOR DESCRIPTION

The ECM monitors the sensor voltage and uses this value to calculate the intake air temperature. When the sensor output voltage deviates from the normal operating range, the ECM interprets this as a malfunction in the intake air temperature sensor and sets a DTC.

Example:

If the sensor output voltage is more than 4.91 V for 0.5 seconds or more, the ECM determines that there is an open in the intake air temperature sensor circuit, and sets DTC P0113. Conversely, if the output voltage is less than 0.18 V for 0.5 seconds or more, the ECM determines that there is a short in the sensor circuit, and sets DTC P0112.

If the malfunction is not repaired successfully, a DTC is set 0.5 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0112: Intake Air Temperature sensor range check (Low voltage) P0113: Intake air temperature sensor range check (High voltage)
Required Sensors/Components (Main)	Intake air temperature sensor

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Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.5 seconds
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
Battery voltage	8 V or more
Power switch	On (IG)

TYPICAL MALFUNCTION THRESHOLDS

P0112

Intake air temperature sensor voltage	Less than 0.18 V

P0113

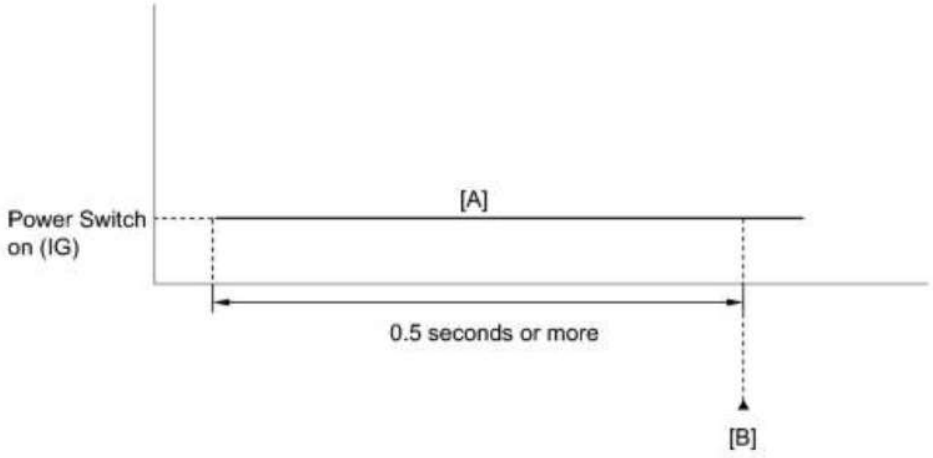
Intake air temperature sensor voltage	More than 4.91 V

COMPONENT OPERATING RANGE

Intake air temperature sensor voltage	0.18 to 4.91 V

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on.
6. Wait 0.5 seconds or more [A].
7. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
8. Read the DTC [B].
9. If a DTC is output, the system is malfunctioning.

   HINT:

   If a DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P0112 or P0113.
12. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment

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Techstream Display	Description
	○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform step [A] again.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Check the judgment result.

HINT:

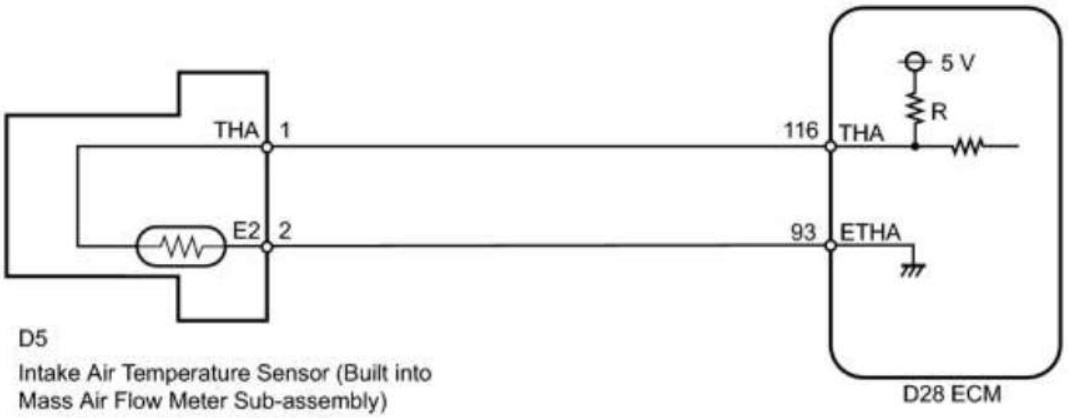
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

15. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

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HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	READ VALUE USING TECHSTREAM (INTAKE AIR TEMPERATURE)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Intake Air.

(e) Read the value displayed on the Techstream.

OK:

Same as actual intake air temperature.

Result:

Result	Proceed to
-40°C (-40°F)	A
140°C (284°F)	B
Same as actual intake air temperature	C

HINT:

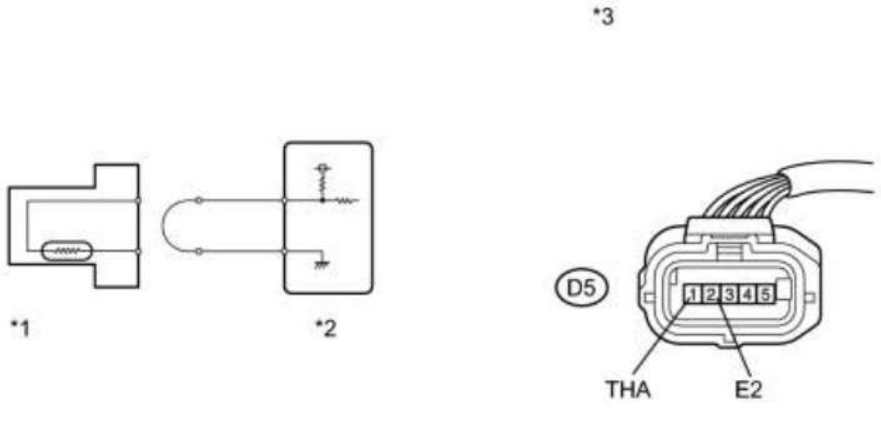
- If there is an open circuit, the Techstream indicates -40°C (-40°F).
- If there is a short circuit, the Techstream indicates 140°C (284°F).

C ▶ CHECK FOR INTERMITTENT PROBLEMS
B ▶ READ VALUE USING TECHSTREAM (CHECK FOR SHORT IN WIRE HARNESS)
A ▼

2.	READ VALUE USING TECHSTREAM (CHECK FOR OPEN IN WIRE HARNESS)

(a) Confirm good connection at the mass air flow meter sub-assembly.

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Text in Illustration

*1	Mass Air Flow Meter Sub-assembly	*2	ECM
*3	Front view of wire harness connector (to Mass Air Flow Meter Sub-assembly)	-	-

(b) Disconnect the mass air flow meter sub-assembly connector.

(c) Connect terminals THA and E2 of the mass air flow meter sub-assembly connector on the wire harness side.

(d) Connect the Techstream to the DLC3.

(e) Turn the power switch on (IG).

(f) Turn the Techstream on.

(g) Enter the following menus: Powertrain / Engine and ECT / Data List / Intake Air.

(h) Read the value displayed on the Techstream.

Standard:

140°C (284°F)

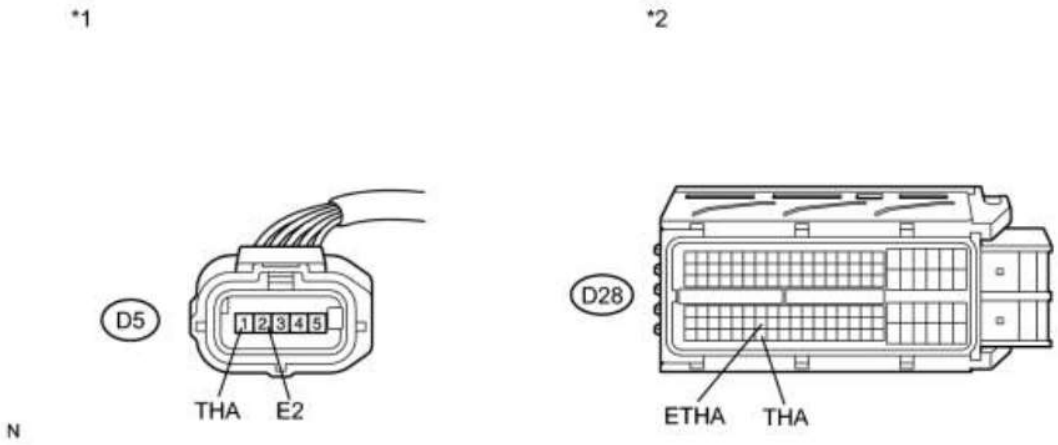
(i) Reconnect the mass air flow meter sub-assembly connector.

NG ▶ CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER SUB-ASSEMBLY - ECM)
OK ▶ **REPLACE MASS AIR FLOW METER SUB-ASSEMBLY**

3.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER SUB-ASSEMBLY - ECM)

(a) Disconnect the mass air flow meter sub-assembly connector.

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(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D5-1 (THA) - D28-116 (THA)	Always	Below 1 Ω
D5-2 (E2) - D28-93 (ETHA)	Always	Below 1 Ω

Text in Illustration

*1	Front view of wire harness connector (to Mass Air Flow Meter Sub-assembly)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the mass air flow meter sub-assembly connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (MASS AIR FLOW METER SUB-ASSEMBLY - ECM)

OK ▶ **REPLACE ECM**

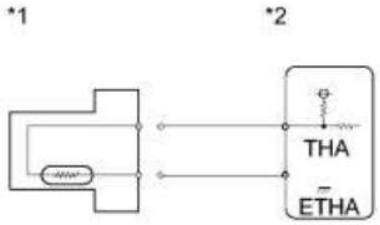
4.	READ VALUE USING TECHSTREAM (CHECK FOR SHORT IN WIRE HARNESS)

(a) Disconnect the mass air flow meter sub-assembly connector.

Text in Illustration

*1	Mass Air Flow Meter Sub-assembly
*2	ECM

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(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (IG).

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT / Intake Air.

(f) Read the value displayed on the Techstream.

Standard value:

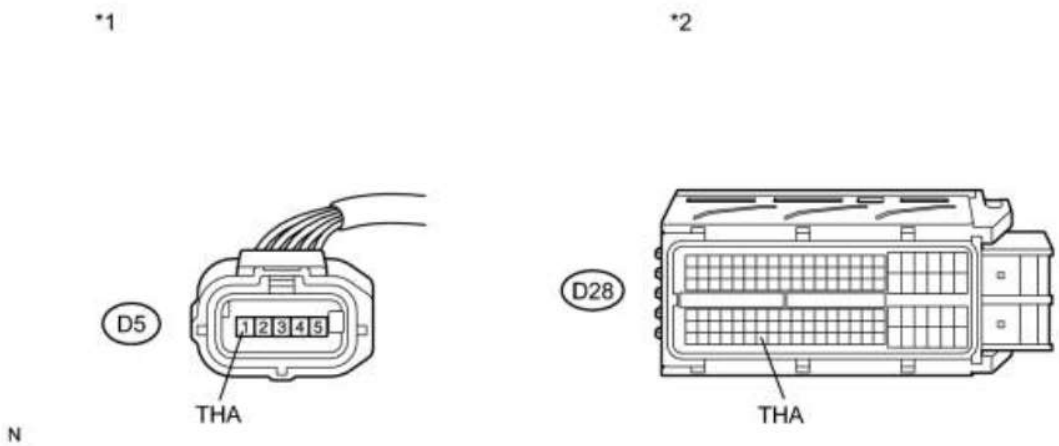
-40°C (-40°F)

(g) Reconnect the mass air flow meter sub-assembly connector.

NG ▶ CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER SUB-ASSEMBLY - ECM)
OK ▶ **REPLACE MASS AIR FLOW METER SUB-ASSEMBLY**

5.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER SUB-ASSEMBLY - ECM)

(a) Disconnect the mass air flow meter sub-assembly connector.



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(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D5-1 (THA) or D28-116 (THA) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Mass Air Flow Meter Sub-assembly)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the mass air flow meter sub-assembly connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (MASS AIR FLOW METER SUB-ASSEMBLY - ECM)

OK ▶ **REPLACE ECM**

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DTC	P0115	Engine Coolant Temperature Circuit Malfunction
DTC	P0117	Engine Coolant Temperature Circuit Low Input
DTC	P0118	Engine Coolant Temperature Circuit High Input

DESCRIPTION

A thermistor, whose resistance value varies according to the engine coolant temperature, is built into the engine coolant temperature sensor.

The structure of the sensor and its connection to the ECM are the same as those of the intake air temperature sensor.

HINT:

When any of DTCs P0115, P0117 and P0118 are set, the ECM enters fail-safe mode. During fail-safe mode, the engine coolant temperature is estimated to be 80°C (176°F) by the ECM. Fail-safe mode continues until a pass condition is detected.

DTC No.	DTC Detection Condition	Trouble Area
P0115	Open or short in engine coolant temperature sensor circuit for 0.5 seconds (1 trip detection logic)	• Open or short in engine coolant temperature sensor circuit • Engine coolant temperature sensor • ECM
P0117	Short in engine coolant temperature sensor circuit for 0.5 seconds (1 trip detection logic)	• Short in engine coolant temperature sensor circuit • Engine coolant temperature sensor • ECM
P0118	Open in engine coolant temperature sensor circuit for 0.5 seconds (1 trip detection logic)	• Open in engine coolant temperature sensor circuit • Engine coolant temperature sensor • ECM

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HINT:

When any of these DTCs are set, check the engine coolant temperature by entering the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.

Temperature Displayed	Malfunction
-40°C (-40°F)	Open circuit
140°C (284°F) or more	Short circuit

MONITOR DESCRIPTION

The engine coolant temperature sensor is used to monitor the engine coolant temperature. The engine coolant temperature sensor has a thermistor with a resistance that varies according to the temperature of the engine coolant. When the coolant temperature becomes low, the resistance in the thermistor increases. When the temperature becomes high, the resistance drops. These variations in resistance are reflected in the output voltage from the sensor. The ECM monitors the sensor voltage and uses this value to calculate the engine coolant temperature. When the sensor output voltage deviates from the normal operating range, the ECM interprets this as a fault in the engine coolant temperature sensor circuit and sets a DTC.

Example:

If the sensor output voltage is more than 4.91 V for 0.5 seconds or more, the ECM determines that there is an open in the engine coolant temperature sensor circuit, and sets DTC P0118. Conversely, if the voltage output is less than 0.14 V for 0.5 seconds or more, the ECM determines that there is a short in the sensor circuit, and sets DTC P0117.

If the malfunction is not repaired successfully, a DTC is set 0.5 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0115: Engine coolant temperature sensor range check (Chattering) P0117: Engine coolant temperature sensor range check (Low voltage) P0118: Engine coolant temperature sensor range check (High voltage)
Required Sensors/Components (Main)	Engine coolant temperature sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.5 seconds
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None

TYPICAL MALFUNCTION THRESHOLDS

P0115

Engine coolant temperature sensor voltage	Less than 0.14 V, or more than 4.91 V

P0117

Engine coolant temperature sensor voltage	Less than 0.14 V

P0118

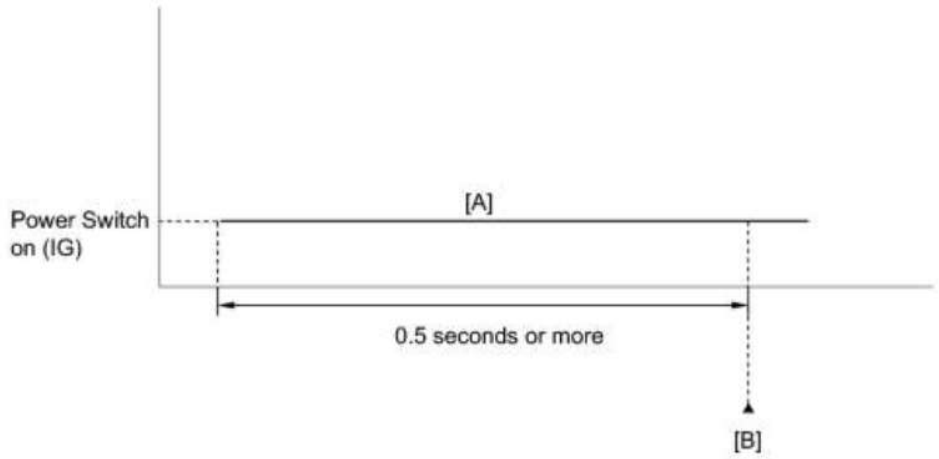
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Engine coolant temperature sensor voltage	More than 4.91 V

COMPONENT OPERATING RANGE

Engine coolant temperature sensor voltage	0.14 to 4.91 V

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on.
6. Wait 0.5 seconds or more [A].
7. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
8. Read the DTC [B].
9. If a DTC is output, the system is malfunctioning.

   HINT:

   If a DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P0115, P0117 or P0118.
12. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed

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Techstream Display	Description
	○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform step [A] again.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

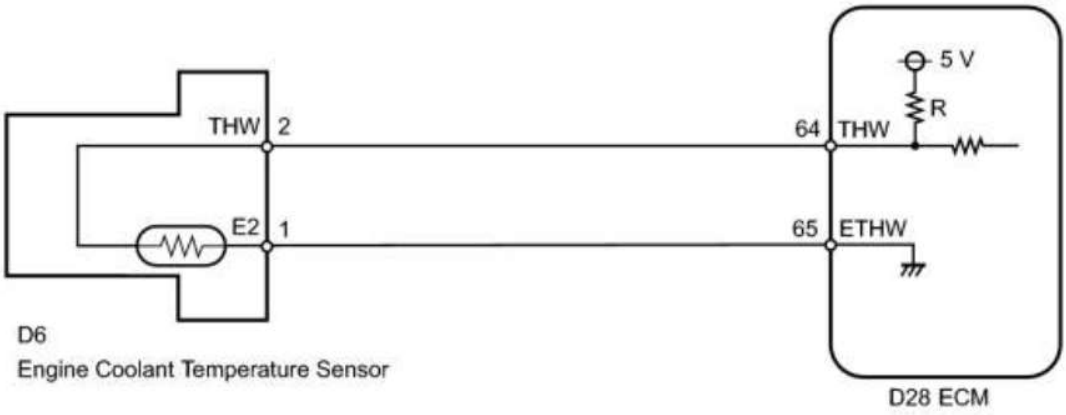
15. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	READ VALUE USING TECHSTREAM (ENGINE COOLANT TEMPERATURE)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.

(e) Read the value displayed on the Techstream.

Standard value:

Between 80°C and 100°C (167°F and 212°F) with warm engine.

Result:

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Result	Proceed to
-40°C (-40°F)	A
140°C (284°F) or more	B
Between 80°C and 100°C (176°F and 212°F)	C

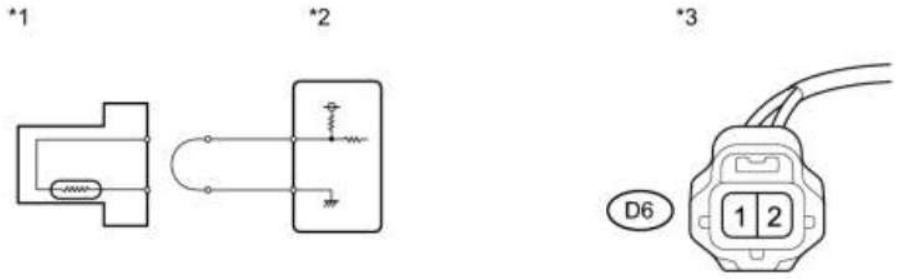
HINT:

- If there is an open circuit, the Techstream indicates -40°C (-40°F).
- If there is a short circuit, the Techstream indicates 140°C (284°F) or more.

C CHECK FOR INTERMITTENT PROBLEMS
B READ VALUE USING TECHSTREAM (CHECK FOR SHORT IN WIRE HARNESS)
A

2.	READ VALUE USING TECHSTREAM (CHECK FOR OPEN IN WIRE HARNESS)

(a) Confirm good connection at the engine coolant temperature sensor connector.



Text in Illustration

*1	Engine Coolant Temperature Sensor	*2	ECM
*3	Front view of wire harness connector (to Engine Coolant Temperature Sensor)	-	-

(b) Disconnect the engine coolant temperature sensor connector.

(c) Connect terminals THW and E2 of the engine coolant temperature sensor connector on the wire harness side.

(d) Connect the Techstream to the DLC3.

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(e) Turn the power switch on (IG).

(f) Turn the Techstream on.

(g) Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.

(h) Read the value displayed on the Techstream.

Standard:

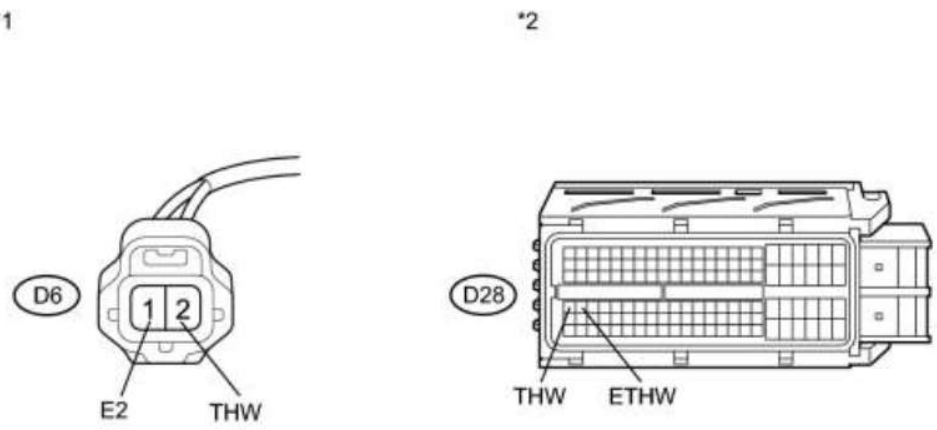
140°C (284°F) or more

(i) Reconnect the engine coolant temperature sensor connector.

NG ▶ CHECK HARNESS AND CONNECTOR (ENGINE COOLANT TEMPERATURE SENSOR - ECM)
OK ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

3.	CHECK HARNESS AND CONNECTOR (ENGINE COOLANT TEMPERATURE SENSOR - ECM)

(a) Disconnect the engine coolant temperature sensor connector.



(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D6-2 (THW) - D28-64 (THW)	Always	Below 1 Ω
D6-1 (E2) - D28-65 (ETHW)	Always	Below 1 Ω

Text in Illustration

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*1	Front view of wire harness connector (to Engine Coolant Temperature Sensor)	*2	Front view of wire harness connector (to ECM)

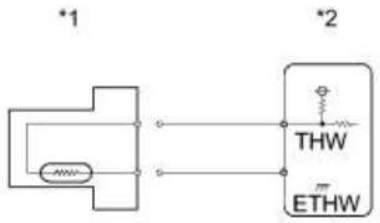
(d) Reconnect the engine coolant temperature sensor connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (ENGINE COOLANT TEMPERATURE SENSOR - ECM)

OK ▶ **REPLACE ECM**

4.	READ VALUE USING TECHSTREAM (CHECK FOR SHORT IN WIRE HARNESS)



(a) Disconnect the engine coolant temperature sensor connector.

Text in Illustration

*1	Engine Coolant Temperature Sensor
*2	ECM

(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (IG).

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.

(f) Read the value displayed on the Techstream.

Standard value:

-40°C (-40°F)

(g) Reconnect the engine coolant temperature sensor connector.

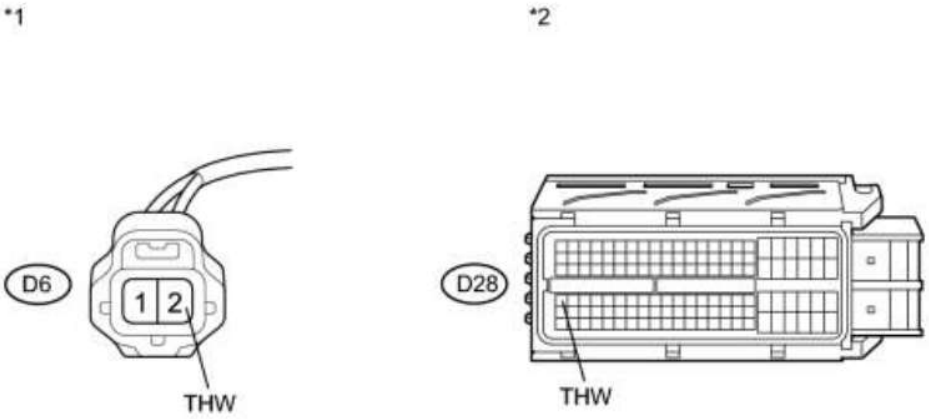
NG ▶ CHECK HARNESS AND CONNECTOR (ENGINE COOLANT TEMPERATURE SENSOR - ECM)

OK ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

5.	CHECK HARNESS AND CONNECTOR (ENGINE COOLANT TEMPERATURE SENSOR - ECM)

(a) Disconnect the engine coolant temperature sensor connector.

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(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D6-2 (THW) or D28-64 (THW) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Engine Coolant Temperature Sensor)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the engine coolant temperature sensor connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (ENGINE COOLANT TEMPERATURE SENSOR - ECM)

OK ▶ **REPLACE ECM**

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DTC	P0116	Engine Coolant Temperature Circuit Range / Performance Problem

DESCRIPTION

Refer to DTC P0115 INFO.

DTC No.	DTC Detection Condition	Trouble Area
P0116	When either of the following conditions is met (2 trip detection logic): • During engine warm up after cold engine starts, change in engine coolant temperature sensor output is below threshold • In duration between warmed engine stopped and next cold engine starts, change in engine coolant temperature sensor output below threshold	• Water inlet with thermostat sub-assembly • Engine coolant temperature sensor
	For Mexico Models: Case 1: Engine coolant temperature between 35°C and 60°C (95°F and 140°F) when engine started, and conditions (a) and (b) met (2 trip detection logic) • (a) Vehicle driven at varying speeds (accelerated and decelerated) • (b) Engine coolant temperature remains within 3°C (5.4°F) of initial engine coolant temperature Case 2: Engine coolant temperature more than 60°C (140°F) when engine started, and conditions (a) and (b) met (6 trip detection logic) • (a) Vehicle driven at varying speeds (accelerated and decelerated) • (b) Engine coolant temperature measurements remain within 1°C (1.8°F) of initial engine coolant temperature on 6 successive occasions	• Water inlet with thermostat sub-assembly • Engine coolant temperature sensor

MONITOR DESCRIPTION

Engine Coolant Temperature Sensor Cold Start Monitor

The monitor runs when the engine is started cold. If the change in engine coolant temperature sensor output until the engine warmed up completely is less than the threshold, it is determined that a malfunction has occurred in the engine coolant temperature sensor. When this is detected in 2 consecutive driving cycles, the MIL is illuminated and the DTC is set.

Engine Coolant Temperature Sensor Soak Monitor

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The ECM compares the engine coolant temperature when the warmed engine is stopped and when the engine is started on the next trip when more than 5 hours has elapsed since the engine was stopped. If the change in engine coolant temperature sensor output is less than the threshold, it is determined that a malfunction has occurred in the engine coolant temperature sensor. When this is detected in 2 consecutive driving cycles, the MIL is illuminated and the DTC is set.

Engine Coolant Temperature Sensor High Side Stuck Monitor (only for Mexico models)

The ECM monitors the sensor voltage and uses this value to calculate the engine coolant temperature. If the sensor voltage output deviates from the normal operating range, the ECM interprets this deviation as a malfunction in the engine coolant temperature sensor and sets the DTC.

Examples:

- Upon starting the engine, the engine coolant temperature is between 35°C and 60°C (95°F and 140°F). If after driving for 250 seconds, the engine coolant temperature remains within 3°C (5.4°F) of the starting temperature, the DTC is set (2 trip detection logic).
- Upon starting the engine, the engine coolant temperature is over 60°C (140°F). If after driving for 250 seconds, the ECM remains within 1°C (1.8°F) of the starting temperature, the DTC is set (6 trip detection logic).

MONITOR STRATEGY

Related DTCs	P0116: Engine coolant temperature sensor cold start monitor P0116: Engine coolant temperature sensor soak monitor
Required Sensors/Components (Main)	Engine coolant temperature sensor
Required Sensors/Components (Related)	None
Frequency of Operation	Once per driving cycle
Duration	5 hours or more
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Engine Coolant Temperature Sensor Cold Start Monitor

Monitor runs whenever following DTCs are not present	None
Battery voltage	10.5 V or more
Time after engine start	1 second or more
Engine coolant temperature at engine start	Less than 60°C (140°F)
Engine coolant temperature circuit (P0115, P0117, P0118, P0125)	OK

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Intake air temperature sensor circuit (P0112, P0113)	OK
Engine coolant pump circuit (P261B, P261C, P261D)	OK
Thermostat fail (P0128)	Not detected
Soak time	0 second or more
Accumulated mass air flow	969 g or more
Fuel cut	OFF
Difference between engine coolant temperature at engine start and intake air temperature	Less than 40°C (72°F)

Engine Coolant Temperature Sensor Soak Monitor

Monitor runs whenever following DTCs are not present	None
Battery voltage	10.5 V or more
Engine	Running
Engine coolant temperature circuit (P0115, P0117, P0118, P0125)	OK
Intake air temperature circuit (P0112, P0113)	OK
Engine coolant pump circuit (P261B, P261C, P261D)	OK
Thermostat fail (P0128)	Not detected
Soak time	5 hours or more
Either of the following condition (a) or (b) is met	-
(a) Engine coolant temperature	60°C (140°F) or more
(b) Accumulated mass air flow	1920 g or more

TYPICAL MALFUNCTION THRESHOLDS

Engine Coolant Temperature Sensor Cold Start Monitor

Engine coolant temperature sensor value change	Less than 5°C (9°F)

Engine Coolant Temperature Sensor Soak Monitor

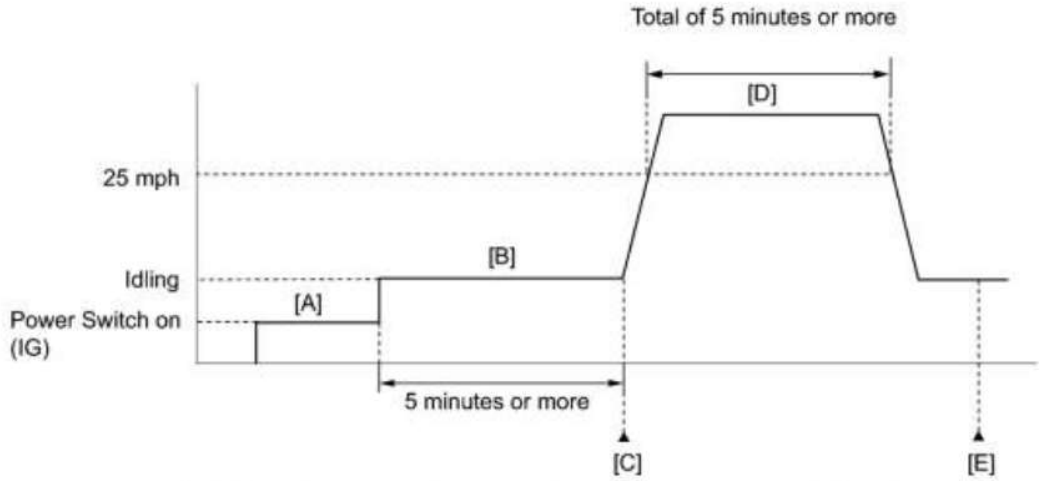
Difference between current engine coolant temperature sensor value and previous engine coolant temperature sensor value when engine stopped	Less than 5°C (9°F)

COMPONENT OPERATING RANGE

Engine coolant temperature	Engine coolant temperature sensor value changes in accordance with actual engine coolant temperature

CONFIRMATION DRIVING PATTERN

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HINT: Start the engine when the engine coolant temperature is 60°C (140°F) or less

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Enter the following menus: Powertrain / Engine and ECT / Data List / All Data / Coolant Temp.
4. Check that the engine coolant temperature is 60°C (140°F) or less.
5. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
6. Turn the power switch off and wait for 30 seconds.
7. Turn the power switch on (IG) and turn the Techstream on [A].
8. Start the engine and idle it for 5 minutes or more [B].

   HINT:

   If the engine coolant temperature does not change by 5°C (9°F) or higher, the engine coolant temperature sensor is malfunctioning. It is not necessary to continue this procedure.

9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
10. Read the pending DTC [C].
11. If a pending DTC is output, the system is malfunctioning.

    HINT:

    If a pending DTC is not output, perform the following procedure.

12. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
13. Input the DTC: P0116.
14. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal

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Techstream Display	Description
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [D] and [E].

15. Drive the vehicle at 25 mph (40 km/h) or more for a total of 5 minutes or more [D].

HINT:

In the event of the drive pattern being interrupted (possibly due to factors such as traffic conditions), the drive pattern can be resumed.

16. Check the DTC judgment result again [E].

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

17. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

- If any of DTCs P0115, P0117, P0118 or P0125 is set simultaneously with DTC P0116, the engine coolant temperature sensor may have an open or a short circuit. Troubleshoot those DTCs first.

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- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0116)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result:

Result	Proceed to
DTC P0116 is output	A
DTC P0116 and other DTCs are output	B

HINT:

If any DTCs other than P0116 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	INSPECT WATER INLET WITH THERMOSTAT SUB-ASSEMBLY

(a) Remove the water inlet with thermostat sub-assembly INFO.

(b) Measure the valve opening temperature of the water inlet with thermostat sub-assembly.

Standard value:

80 to 84°C (176 to 183°F)

HINT:

In addition to the above check, confirm that the valve is completely closed when the temperature is below the standard.

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(c) Reinstall the water inlet with thermostat sub-assembly INFO.

NG ▶ REPLACE WATER INLET WITH THERMOSTAT SUB-ASSEMBLY
OK ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

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DTC	P011B	Engine Coolant Temperature / Intake Air Temperature Correlation

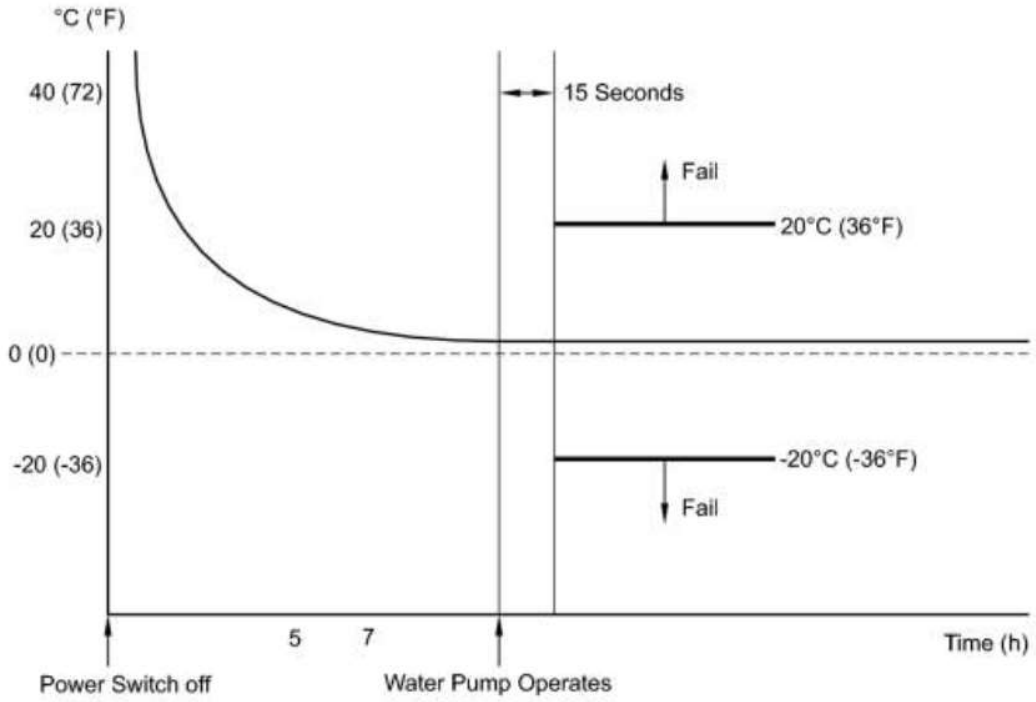
DESCRIPTION

The engine has two temperature sensors, an engine coolant temperature sensor and an intake air temperature sensor, to detect the temperature while the engine is operating. A thermistor, whose resistance value varies according to the temperature, is built into each sensor. When the temperature is low, the resistance of the thermistor increases. When the temperature is high, the resistance drops. These variations in resistance are transmitted to the ECM as voltage changes. Based on these temperature signals output from the sensors, the ECM determines the fuel injection duration and the ignition timing to control the engine.

DTC No.	DTC Detection Condition	Trouble Area
P011B	• All of following conditions are met: (2 trip detection logic) a. Battery voltage 10.5 V or more b. 7 hours or more elapsed from engine stops on previous trip c. 15 seconds after water pump operates d. Minimum intake air temperature after engine starts more than -10°C (14°F) e. Average engine coolant temperature before engine starts more than -10°C (14°F) f. Difference between readings of engine coolant temperature and intake air temperature greater than 20°C (36°F)	• Intake air temperature sensor • Engine coolant temperature sensor • ECM

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Difference Between Engine Coolant Temperature and Intake Air Temperature



HINT:

- Waiting is required to prevent the temperature of the engine from affecting the readings. If the engine has been operated recently, it will not be possible to accurately compare the readings.
- For diagnosis, in order to duplicate the detection conditions of the DTC, it is necessary to park the vehicle for 7 hours. Parking the vehicle for 7 hours ensures that the actual temperature of the engine coolant temperature and intake air temperature are very similar. When the vehicle has been parked for less than 7 hours, differences in the readings may exist, this does not necessarily indicate a fault.

MONITOR DESCRIPTION

The ECM monitors the difference between the engine coolant temperature and the intake air temperature when the engine is started cold to detect the engine temperature conditions accurately. The monitor runs when the engine started cold after 7 hours or more has elapsed since the engine was stopped (power switch turned off) on the previous trip. If the difference between the engine coolant temperature and the intake air temperature on a cold start exceeds 20°C (36°F), the ECM interprets this as a malfunction in the engine coolant temperature sensor circuit and intake air temperature sensor circuit, and sets the DTC.

MONITOR STRATEGY

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Related DTCs	P011B: Engine coolant temperature / Intake air temperature sensor correlation
Required Sensors/Components (Main)	Engine coolant temperature sensor Intake air temperature sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Once per driving cycle
Duration	7 hours or more
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

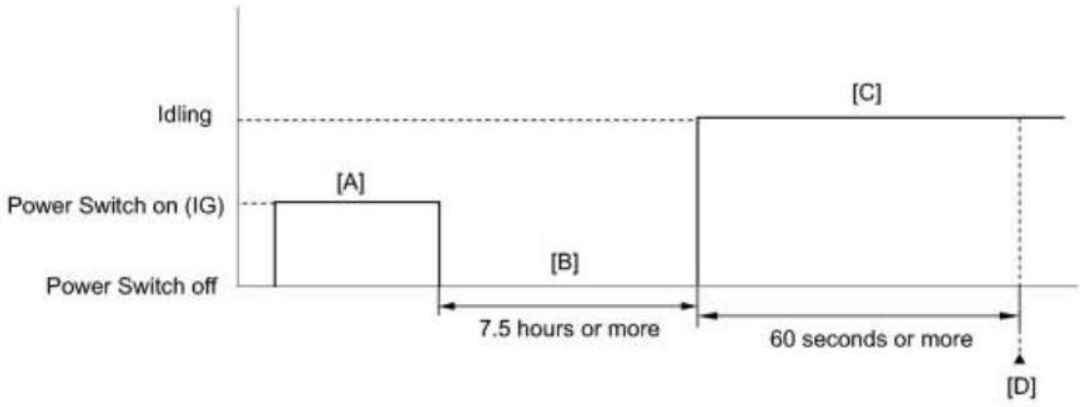
Monitor runs whenever following DTCs are not present	None
All of the following conditions are met	-
Soak time	7 hours or more
Battery voltage	10.5 V or more
Time after engine start	0 second or more
Either of the following conditions is met	(a) or (b)
(a) Minimum intake air temperature after engine start	-10°C or more
(b) Engine coolant temperature before engine start	-10°C or more
Engine coolant temperature sensor circuit fail (P0115, P0117, P0118, P0125)	Not detected
Intake air temperature sensor circuit fail (P0112, P0113)	Not detected
Mass air flow meter circuit fail (P0102, P0103)	Not detected
Soak timer circuit fail (P2610)	Not detected
Engine coolant pump circuit fail (P261B, P261C, P261D)	Not detected
Engine coolant pump operation signal input	15 seconds or more
Accumulated intake air	141 g or more

TYPICAL MALFUNCTION THRESHOLDS

Deviated engine coolant temperature and intake air temperature	Less than -20°C (-36°F) or more than 20°C (36°F)

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO [A].
4. Turn the power switch off.
5. With the engine stopped, leave the vehicle as is for 7.5 hours or more [B].
6. Turn the power switch on (IG) and turn the Techstream on.
7. Put the engine in inspection mode INFO.
8. Start the engine and wait 60 seconds or more [C].
9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
10. Read the pending DTC [D].
11. If a pending DTC is output, the system is malfunctioning.

    HINT:

    If a pending DTC is not output, perform the following procedure.

12. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
13. Input the DTC: P011B.
14. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed

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Techstream Display	Description
	○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [A] through [C] again.

15. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
16. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

17. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO P011B)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

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(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result:

Result	Proceed to
DTC P011B is output	A
DTC P011B and other DTCs are output	B

HINT:

If any DTCs other than P011B are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	READ VALUE USING TECHSTREAM (INTAKE AIR TEMPERATURE)

(a) Leave the vehicle for 7 hours or more.

HINT:

It is necessary to leave the vehicle for 7 hours or more to allow conditions similar to the DTC detection conditions.

(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (IG).

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine and ECT / Intake Air.

(f) Read the value displayed on the Techstream.

OK:

The difference between the intake air temperature and the actual outside air temperature is within 10°C (18°F).

HINT:

Temperature readings on the vehicle's outside temperature gauge (if equipped) are not suitable for comparing to the intake air temperature reading. The outside temperature gauge has a significant delay built in to prevent temperature swings from being displayed on its display. Use an accurate thermometer to determine the outside air temperature.

NG ▶ REPLACE MASS AIR FLOW METER SUB-ASSEMBLY

OK

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3.	READ VALUE USING TECHSTREAM (COOLANT TEMPERATURE)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Coolant Temp.

(e) Read the value displayed on the Techstream.

OK:

The difference between the coolant temperature and the actual outside air temperature is within 10°C (18°F).

HINT:

If the result is not as specified, check if there are heat sources such as a block heater in the engine compartment.

NG ▶ REPLACE ENGINE COOLANT TEMPERATURE SENSOR
OK ▶ **REPLACE ECM**

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DTC	P0120	Throttle / Pedal Position Sensor / Switch "A" Circuit Malfunction
DTC	P0121	Throttle / Pedal Position Sensor / Switch "A" Circuit Range / Performance Problem
DTC	P0122	Throttle / Pedal Position Sensor / Switch "A" Circuit Low Input
DTC	P0123	Throttle / Pedal Position Sensor / Switch "A" Circuit High Input
DTC	P0220	Throttle / Pedal Position Sensor / Switch "B" Circuit
DTC	P0222	Throttle / Pedal Position Sensor / Switch "B" Circuit Low Input
DTC	P0223	Throttle / Pedal Position Sensor / Switch "B" Circuit High Input
DTC	P2135	Throttle / Pedal Position Sensor / Switch "A" / "B" Voltage Correlation

DESCRIPTION

HINT:

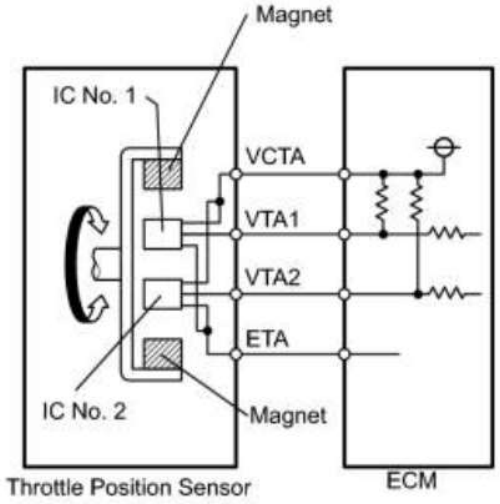
- These DTCs relate to the throttle position sensor.

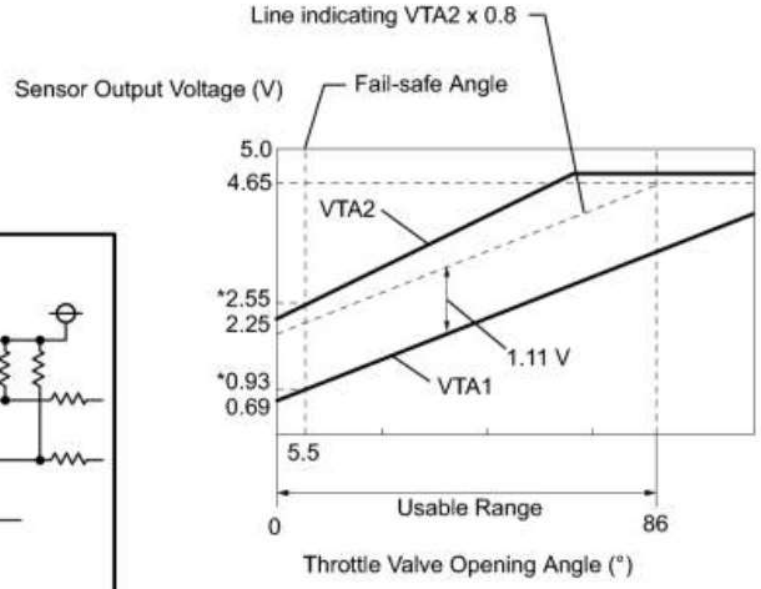
The throttle position sensor is mounted on the throttle body assembly, and detects the opening angle of the throttle valve. This sensor is a non-contact type. It uses Hall-effect elements in order to yield accurate signals even in extreme conditions.

The throttle position sensor has 2 sensor circuits, each of which transmits a signal, VTA1 and VTA2. VTA1 is used to detect the throttle valve angle and VTA2 is used to detect malfunctions in VTA1. The sensor signal voltages vary between 0 V and 5 V in proportion to the throttle valve opening angle, and are transmitted to the VTA terminals of the ECM.

As the valve closes, the sensor output voltage decreases and as the valve opens, the sensor output voltage increases. The ECM calculates the throttle valve opening angle according to these signals and controls the throttle actuator in response to driver inputs. These signals are also used in calculations such as air fuel ratio correction, power enrichment correction and fuel-cut control.

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Note:

The throttle valve opening angle detected by the sensor terminal VTA1 is expressed as a percentage.

Between 10% and 22%: Throttle valve fully closed

Between 64% and 96%: Throttle valve fully open

Approximately 18.6%: Fail safe angle (5.5°)

Features of sensor output:

The difference in voltage between VTA1 and VTA2 x 0.8 is approximately 1.11 V.

(VTA2 × 0.8 is approximately equal to VTA1 + 1.11 V)

DTC No.	DTC Detection Condition	Trouble Area
P0120	Output voltage of VTA1 quickly fluctuates beyond lower and upper malfunction thresholds for 2 seconds or more (1 trip detection logic)	• Throttle position sensor (built into throttle body assembly) • ECM
P0121	Difference between VTA1 and VTA2 voltages less than 0.8 V, or more than 1.6 V for 2 seconds (1 trip detection logic)	• Throttle position sensor (built into throttle body assembly) • Throttle position sensor circuit • ECM
P0122	Output voltage of VTA1 0.2 V or less for 2 seconds or more (1 trip detection logic)	• Throttle position sensor (built into throttle body assembly) • Short in VTA1 circuit

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DTC No.	DTC Detection Condition	Trouble Area
		• Open in VC circuit • ECM
P0123	Output voltage of VTA1 4.54 V or more for 2 seconds or more (1 trip detection logic)	• Throttle position sensor (built into throttle body assembly) • Open in VTA1 circuit • Open in E2 circuit • Short between VC and VTA1 circuits • ECM
P0220	Output voltage of VTA2 quickly fluctuates beyond lower and upper malfunction thresholds for 2 seconds or more (1 trip detection logic)	• Throttle position sensor (built into throttle body assembly) • ECM
P0222	Output voltage of VTA2 1.75 V or less for 2 seconds or more (1 trip detection logic)	• Throttle position sensor (built into throttle body assembly) • Short in VTA2 circuit • Open in VC circuit • ECM
P0223	Output voltage of VTA2 4.8 V or more, and VTA1 between 0.2 V and 2.02 V, for 2 seconds or more (1 trip detection logic)	• Throttle position sensor (built into throttle body assembly) • Open in VTA2 circuit • Open in E2 circuit • Short between VC and VTA2 circuits • ECM
P2135	Either condition (a) or (b) met (1 trip detection logic): (a) Difference between output voltages of VTA1 and VTA2 0.02 V or less for 0.5 seconds or more	• Short between VTA1 and VTA2 circuits • Throttle position sensor (built into

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DTC No.	DTC Detection Condition	Trouble Area
	(b) Output voltage of VTA1 is 0.2 V or less, and VTA2 is 1.75 V or less, for 0.4 seconds or more	throttle body assembly) • ECM

MONITOR DESCRIPTION

P0120, P0122, P0123, P0220, P0222, P0223, P2135

The ECM uses the throttle position sensor to monitor the throttle valve opening angle. There are several checks that the ECM performs to confirm the proper operation of the throttle position sensor.

- A specific voltage difference is expected between the sensor terminals, VTA1 and VTA2, for each throttle valve opening angle. If the difference between VTA1 and VTA2 is incorrect, the ECM interprets this as a malfunction in the sensor circuit, and sets a DTC.
- VTA1 and VTA2 each have a specific voltage range. If VTA1 or VTA2 is outside the normal operating range, the ECM interprets this as a malfunction in the sensor circuit, and sets a DTC.
- VTA1 and VTA2 should never be close to the same voltage level. If VTA1 is within 0.02 V of VTA2, the ECM determines that there is a short circuit in the sensor circuit, and sets a DTC.

If the malfunction is not repaired successfully, a DTC is set 10 seconds after the engine is next started.

P0121

This sensor transmits two signals: VTA1 and VTA2. VTA1 is used to detect the throttle opening angle and VTA2 is used to detect malfunctions in VTA1. The ECM performs several checks to confirm the proper operation of the throttle position sensor and VTA1.

For each throttle opening angle, a specific voltage difference is expected between the outputs of VTA1 and VTA2. If the output voltage difference between the two signals deviates from the normal operating range, the ECM interprets this as a malfunction in the throttle position sensor. The ECM illuminates the MIL and stores the DTC.

If the malfunction is not repaired successfully, the DTC is stored 2 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0120: Throttle position sensor 1 range check (Chattering) P0121: Throttle position sensor rationality P0122: Throttle position sensor 1 range check (Low voltage) P0123: Throttle position sensor 1 range check (High voltage)

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	P0220: Throttle position sensor 2 range check (Chattering) P0222: Throttle position sensor 2 range check (Low voltage) P0223: Throttle position sensor 2 range check (High voltage) P2135: Throttle position sensor range check (Correlation)
Required Sensors/Components (Main)	Throttle position sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	2 seconds: P0120, P0122, P0123, P0220, P0222 and P0223 Within 2 seconds: P0121 0.5 seconds: P2135 Case 1 0.4 seconds: P2135 Case 2
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

P0120, P0122, P0123, P0220, P0222, P0223, P2135:

Monitor runs whenever following DTCs are not present	None
Either of the following conditions A or B is met	-
Power switch on (IG)	0.012 seconds or more
B. Electronic throttle actuator power	ON

P0121:

Monitor runs whenever following DTCs are not present	None
Either of the following conditions A or B is set	-
A. Power switch	On (IG)
B. Electric throttle motor power	ON
Throttle position sensor malfunction (P0120, P0122, P0123, P0220, P0222, P0223, P2135)	Not detected

TYPICAL MALFUNCTION THRESHOLDS

P0120

VTA1 voltage	0.2 V or less, or 4.54 V or more

P0121

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Either of the following conditions is set	-
Difference of throttle position sensor voltage between VTA1 and (VTA2 x 0.8)	Higher than 1.6 V
Difference of throttle position sensor voltage between VTA1 and (VTA2 x 0.8)	Lower than 0.8 V

P0122

VTA1 voltage	0.2 V or less

P0123

VTA1 voltage	4.54 V or more

P0220

Either of the following conditions is met	A or B
A. VTA2 voltage	1.75 V or less
B. All of the following conditions are met	(a) and (b)
(a) VTA2 voltage	4.8 V or more
(b) VTA1 voltage	0.2 V or more, and 2.02 V or less

P0222

VTA2 voltage	1.75 V or less

P0223

VTA2 voltage when VTA1 0.2 V or more, and 2.02 V or less	4.8 V or more

P2135 Case 1

Difference between VTA1 and VTA2 voltages	0.02 V or less

P2135 Case 2

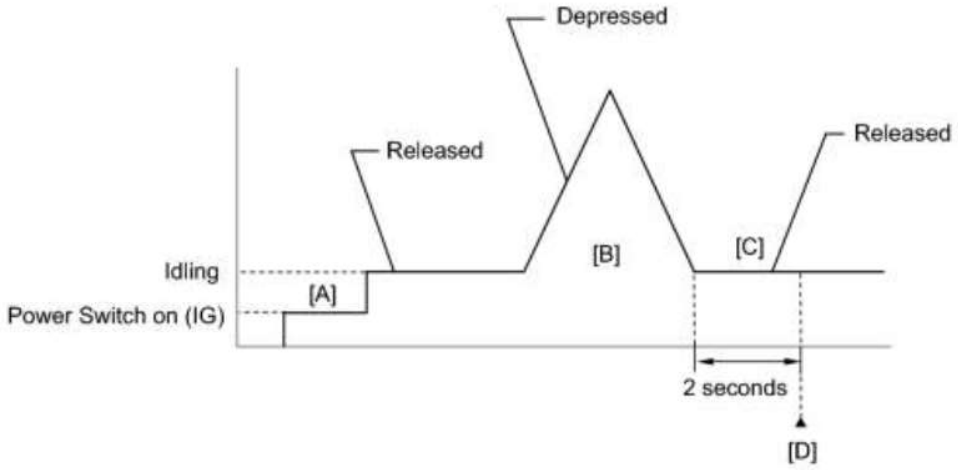
VTA1 voltage	0.2 V or less
VTA2 voltage	1.75 V or less

COMPONENT OPERATING RANGE

VTA1 voltage	0.2 to 4.54 V
VTA2 voltage	1.75 to 4.8 V

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine.
8. With the vehicle stationary, fully depress and release the accelerator pedal [B].
9. Idle the engine for 2 seconds or more [C].
10. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
11. Read the DTC [D].
12. If a DTC is output, the system is malfunctioning.

    HINT:

    If a DTC is not output, perform the following procedure.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Input the DTC: P0120, P0121, P0122, P0123, P0220, P0222, P0223 or P2135.
15. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed

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Techstream Display	Description
	○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [B] and [C] again.

16. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
17. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

18. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

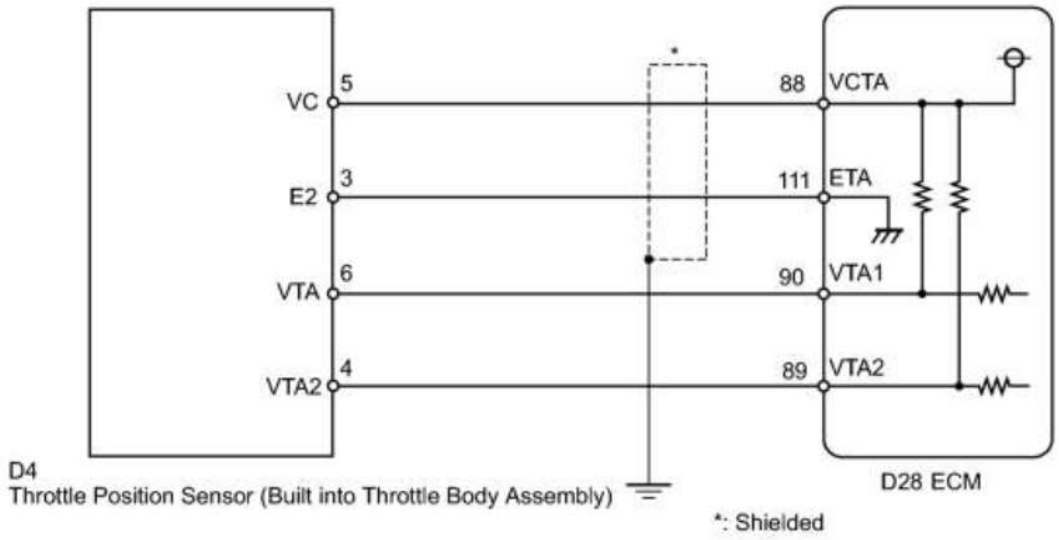
FAIL-SAFE

When any of these DTCs, as well as other DTCs relating to electronic throttle control system malfunctions, are set, the ECM enters fail-safe mode. During fail-safe mode, the ECM cuts the current to the throttle actuator, and the throttle valve is returned to a 5.5° throttle angle by the return spring. The ECM stops the engine and the vehicle can be driven using solely the hybrid system. If the accelerator pedal is depressed firmly and gently, the vehicle can be driven slowly.

Fail-safe mode continues until a pass condition is detected, and the power switch is then turned off.

WIRING DIAGRAM

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INSPECTION PROCEDURE

HINT:

- DTC P0121 is stored when the voltages output from VTA1 and VTA2 are not consistent with the characteristics of the sensors. Therefore, check the Freeze Frame Data when this DTC is output. Use the following formula to confirm relative fluctuations in voltage.

  Features of sensor output:

  VTA2 x 0.8 is approximately equal to VTA1 + 1.11 V

  VTA1: Throttle Position No. 1

  VTA2: Throttle position No. 2

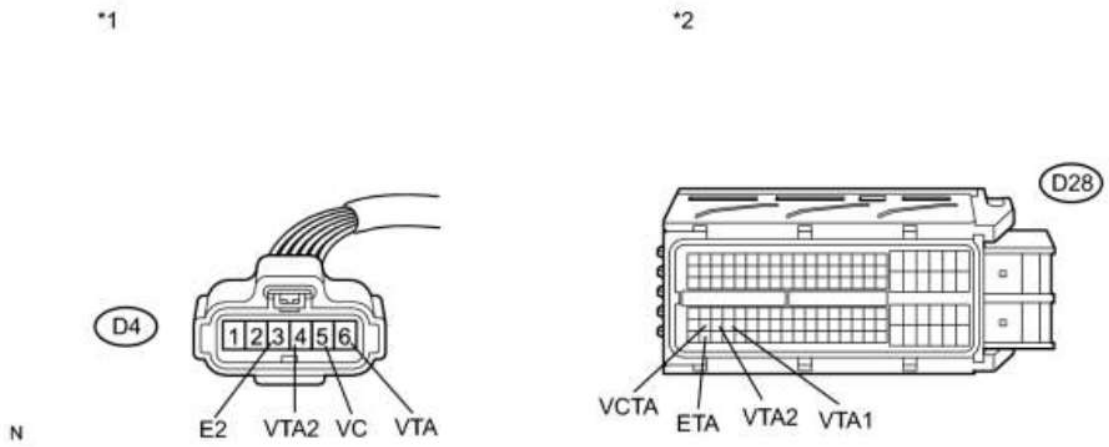
- If DTC P0121 is output, proceed to "CHECK HARNESS AND CONNECTOR (THROTTLE POSITION SENSOR - ECM)".
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	CHECK HARNESS AND CONNECTOR (THROTTLE POSITION SENSOR - ECM)

(a) Disconnect the throttle body assembly connector.

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(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D4-5 (VC) - D28-88 (VCTA)	Always	Below 1 Ω
D4-6 (VTA) - D28-90 (VTA1)	Always	Below 1 Ω
D4-4 (VTA2) - D28-89 (VTA2)	Always	Below 1 Ω
D4-3 (E2) - D28-111 (ETA)	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D4-5 (VC) or D28-88 (VCTA) - Body ground	Always	10 kΩ or higher
D4-6 (VTA) or D28-90 (VTA1) - Body ground	Always	10 kΩ or higher
D4-4 (VTA2) or D28-89 (VTA2) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Throttle Body Assembly)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the throttle body assembly connector.

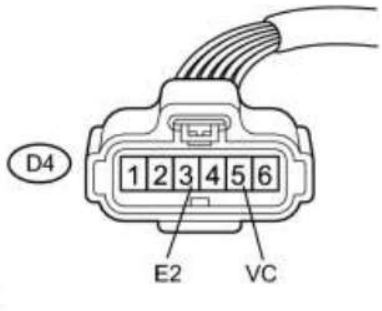
(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (THROTTLE POSITION SENSOR - ECM)
OK

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2.	INSPECT ECM (VC VOLTAGE)

*1



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(a) Disconnect the throttle body assembly connector.

(b) Turn the power switch on (IG).

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Condition	Specified Condition
D4-5 (VC) - D4-3 (E2)	Power switch on (IG)	4.5 to 5.5 V

Text in Illustration

*1	Front view of wire harness connector (to Throttle Body Assembly)

(d) Reconnect the throttle body assembly connector.

NG ▶ REPLACE ECM

OK

3.	REPLACE THROTTLE BODY ASSEMBLY

(a) Replace the throttle body assembly INFO.

NEXT

4.	CHECK WHETHER DTC OUTPUT RECURS (THROTTLE POSITION SENSOR DTCS)

(a) Connect the Techstream to the DLC3.

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(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Put the engine in inspection mode INFO.

(f) Start the engine.

(g) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(h) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(i) Read the DTCs.

Result:

Result	Proceed to
DTC P0120, P0121, P0122, P0123, P0220, P0222, P0223 and/or P2135 is output	A
DTC is not output	B

B ▶ END

A ▶ **REPLACE ECM**

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DTC	P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control

DESCRIPTION

Refer to DTC P0115 INFO.

DTC No.	DTC Detection Condition	Trouble Area
P0125	Engine coolant temperature does not reach closed-loop enabling temperature for 20 minutes (this period varies with engine start engine coolant temperature) (2 trip detection logic)	• Cooling system • Engine coolant temperature sensor • Water inlet with thermostat sub-assembly

MONITOR DESCRIPTION

The resistance of the engine coolant temperature sensor varies in proportion to the actual engine coolant temperature. The ECM supplies a constant voltage to the sensor and monitors the signal output voltage of the sensor. The signal output voltage varies according to the changing resistance of the sensor. After the engine is started, the engine coolant temperature is monitored through this signal. If the engine coolant temperature sensor indicates that the engine is not yet warm enough for closed-loop fuel control, despite a specified period of time having elapsed since the engine was started, the ECM interprets this as a malfunction in the sensor or cooling system and sets the DTC.

Example:

The engine coolant temperature is 5°C (41°F) at engine start. After about 1 minute running time, the engine coolant temperature sensor still indicates that the engine is not warm enough to begin closed-loop fuel (air fuel ratio feedback) control. The ECM interprets this as a malfunction in the sensor or cooling system and sets the DTC.

MONITOR STRATEGY

Related DTCs	P0125: Insufficient engine coolant temperature for closed-loop fuel control
Required Sensors/Components (Main)	Engine coolant temperature sensor Thermostat Cooling system
Required Sensors/Components (Related)	-
Frequency of Operation	Once per driving cycle
Duration	85 seconds: Engine coolant temperature at engine start -3.33°C (26°F) or more

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	164 seconds: Engine coolant temperature at engine start -14.44 to -3.33°C (6 to 26°F) 1200 seconds: Engine coolant temperature at engine start less than -14.44°C (6°F)
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

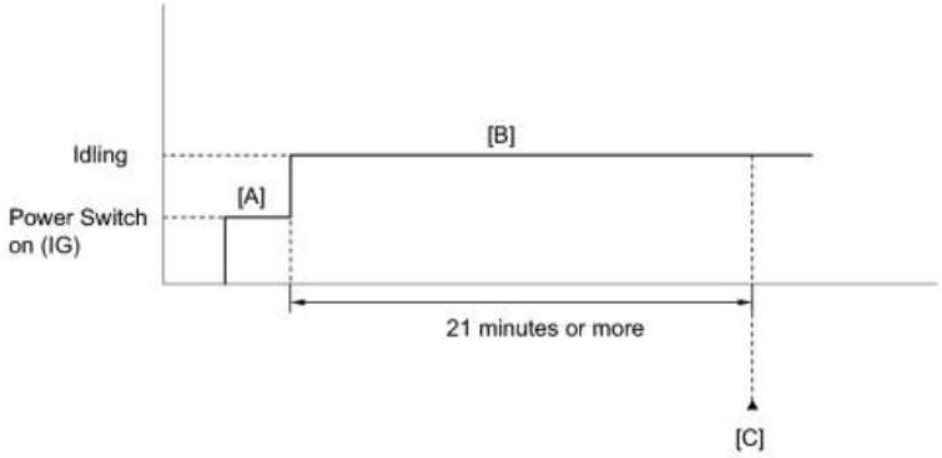
Monitor runs whenever following DTCs are not present	None
Thermostat fail (P0128)	Not detected
Intake air temperature sensor circuit fail (P0112, P0113)	Not detected
Engine coolant temperature sensor circuit fail (P0115, P0117, P0118)	Not detected
Mass air flow meter circuit fail (P0102, P0103)	Not detected

TYPICAL MALFUNCTION THRESHOLDS

Time until actual engine coolant temperature reaches closed-loop fuel control enabling temperature	85 seconds: Engine coolant temperature at engine start -3.33°C (26°F) or more 164 seconds: Engine coolant temperature at engine start -14.44 to -3.33°C (6 to 26°F) 1200 seconds: Engine coolant temperature at engine start less than -14.44°C (6°F)

CONFIRMATION DRIVING PATTERN

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1. Leave the vehicle outside overnight.
2. Connect the Techstream to the DLC3.
3. Turn the power switch on (IG) and turn the Techstream on.
4. Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.
5. Check that the engine coolant temperature is 5°C (41°F) or less.
6. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
7. Turn the power switch off and wait for 30 seconds..
8. Turn the power switch on (IG) and turn the Techstream on [A].
9. Put the engine in inspection mode INFO.
10. Start the engine.
11. After starting the engine, wait 21 minutes or more [B].
12. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
13. Read the pending DTC [C].
14. If a pending DTC is output, the system is malfunctioning.

HINT:

If a pending DTC is not output, perform the following procedure.

15. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
16. Input the DTC: P0125.
17. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal

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Techstream Display	Description
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform step [B] again.

18. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
19. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

20. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0115 INFO.

INSPECTION PROCEDURE

HINT:

- If any of DTCs P0115, P0116, P0117 or P0118 is set simultaneously with DTC P0125, the engine coolant temperature sensor may have an open or a short circuit. Troubleshoot those DTCs first.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

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1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0125)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream ON.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result:

Result	Proceed to
DTC P0125 is output	A
DTC P0125 and other DTCs are output	B

HINT:

If any DTCs other than P0125 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	INSPECT WATER INLET WITH THERMOSTAT SUB-ASSEMBLY

(a) Remove the water inlet with thermostat sub-assembly INFO.

(b) Check the valve opening temperature of the water inlet with thermostat sub-assembly.

Standard value:

80 to 84°C (176 to 183°F)

HINT:

In addition to the above check, confirm that the valve is completely closed when the temperature is below the standard.

(c) Reinstall the water inlet with thermostat sub-assembly INFO.

NG ▶ REPLACE WATER INLET WITH THERMOSTAT SUB-ASSEMBLY

OK ▼

3.	CHECK COOLING SYSTEM

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(a) Check for defects in the cooling system that might cause the system to be too cold, such as abnormal radiator fan operation or any modifications.

NG ▶ REPAIR OR REPLACE COOLING SYSTEM
OK ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

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DTC	P0128	Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)

DESCRIPTION

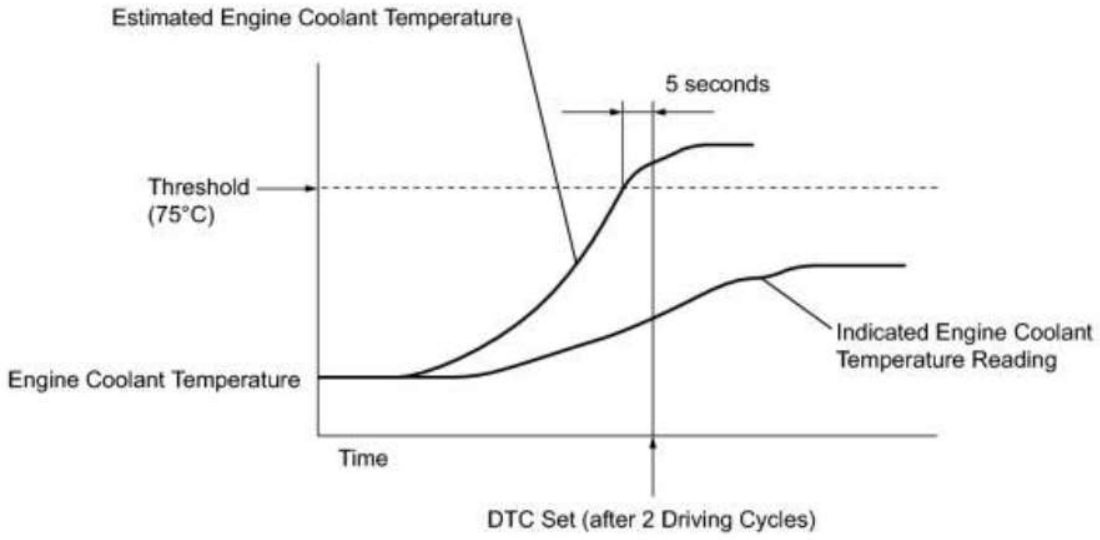
HINT:

- This DTC relates to the water inlet with thermostat sub-assembly.

This DTC is set when the engine coolant temperature does not reach 75°C (167°F) despite sufficient engine warm-up time having elapsed.

DTC No.	DTC Detection Condition	Trouble Area
P0128	• Conditions (a), (b) and (c) are met for 5 seconds (2 trip detection logic): • (a) Cold start • (b) Engine warmed up • (c) Engine coolant temperature less than 75°C (167°F)	• Water inlet with thermostat sub-assembly • Cooling system • Engine coolant temperature sensor • ECM

MONITOR DESCRIPTION



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The ECM estimates the engine coolant temperature based on the starting temperature, engine loads, and engine speeds. The ECM then compares the estimated temperature with the actual engine coolant temperature. When

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the estimated engine coolant temperature reaches 75°C (167°F), the ECM checks the actual engine coolant temperature. If the actual engine coolant temperature is less than 75°C (167°F), the ECM interprets this as a malfunction in the water inlet with thermostat sub-assembly or the engine cooling system and sets the DTC.

MONITOR STRATEGY

Related DTCs	P0128: Coolant Thermostat
Required Sensors/Components (Main)	Thermostat Engine coolant temperature sensor
Required Sensors/Components (Related)	Intake air temperature sensor
Frequency of Operation	Once per driving cycle
Duration	900 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	P0010 (VVT Oil Control Valve Bank 1) P0011 (VVT System Bank 1 - Advance) P0012 (VVT System Bank 1 - Retard) P0016 (VVT System Bank 1 - Misalignment) P0031, P0032, P101D (Air Fuel Ratio Sensor Heater - Sensor 1) P0102, P0103 (Mass Air Flow Meter) P0107, P0108 (Manifold Absolute Pressure) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0171, P0172 (Fuel System) P0301, P0302, P0303, P0304 (Misfire) P0335 (Crankshaft Position Sensor)

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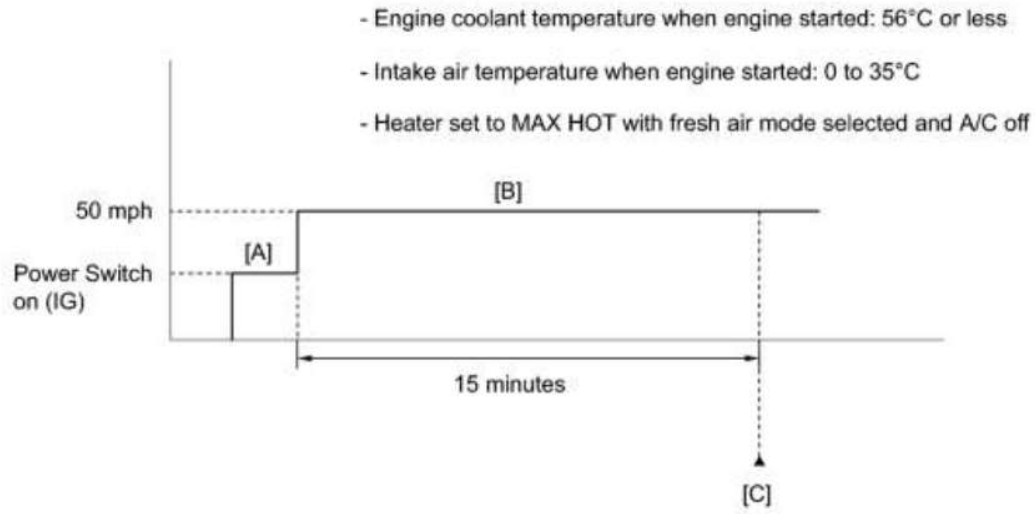
	P0340, P0342, P0343 (Camshaft Position Sensor) P0351, P0352, P0353, P0354 (Igniter) P0401 (EGR System (Closed)) P2195, P2196, P2237, P2238, P2239, P2252, P2253, P2A00 (Air Fuel Ratio Sensor - Sensor 1)
Battery voltage	11 V or more
Either of the following conditions 1 or 2 is met:	-
1. All of following conditions are met:	(a), (b) and (c)
(a) Engine coolant temperature at engine start - Intake air temperature at engine start	-15 to 7°C (-27 to 12.6°F)
(b) Engine coolant temperature at engine start	-10 to 56°C (14 to 133°F)
(c) Intake air temperature at engine start	-10 to 56°C (14 to 133°F)
2. All of the following conditions are met:	(d), (e) and (f)
(d) Engine coolant temperature at engine start - Intake air temperature at engine start	More than 7°C (12.6°F)
(e) Engine coolant temperature at engine start	56°C (133°F) or less
(f) Intake air temperature at engine start	-10°C (14°F) or more
Accumulated time at 80 mph (128 km/h) or more	Less than 20 seconds

TYPICAL MALFUNCTION THRESHOLDS

Duration that both of the following conditions (a) and (b) are met	5 seconds or more
(a) Estimated engine coolant temperature	75°C (167°F) or more
(b) Engine coolant temperature sensor output	Less than 75°C (167°F)

CONFIRMATION DRIVING PATTERN

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1. Stop the engine and allow it to cool down.
2. Connect the Techstream to the DLC3.
3. Turn the power switch on (IG) and turn the Techstream on [A].
4. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
5. Enter the following menus: Powertrain / Engine and ECT / Data List / All Data / Coolant Temp and Intake Air.
6. Check if "Coolant Temp" is 56°C (133°F) or less and "Intake Air" is between 0 and 35°C (32 and 95°F).
7. Put the engine in inspection mode INFO.
8. Set the heater to MAX HOT with fresh air mode selected and turn the A/C off.
9. Start the engine and drive the vehicle at 50 mph (80 km/h) for 15 minutes [B].

   HINT:

   - Data can be captured relatively easily by using the snapshot function in the Data List.
   - Enter the following menus: Data List / Function / Snap-shot configuration / Record time / 5 min.
   - Data capture can be started by using the target point. For example, setting the target point to an Accel of 90% and then racing the engine, etc. to raise the engine speed to a speed of 2500 rpm or more will cause data capture to start.
10. After driving the vehicle at 50 mph (80 kmh) and "Coolant Temp" stabilizes, check that "Coolant Temp" is 75°C (167°F) or higher [C].

    HINT:

    If "Coolant Temp" is below 75°C (167°F) while driving the vehicle at 50 mph (80 km/h), inspect the cooling system and thermostat.

INSPECTION PROCEDURE

HINT:

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Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0128)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result:

Result	Proceed to
DTC P0128 is output	A
DTC P0128 and other DTCs are output	B

HINT:

If any DTCs other than P0128 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK COOLING SYSTEM

(a) Check for defects in the cooling system that might cause the system to be too cold, such as abnormal radiator fan operation or any modifications.

NG ▶ REPAIR OR REPLACE COOLING SYSTEM

OK ▼

3.	INSPECT WATER INLET WITH THERMOSTAT SUB-ASSEMBLY

(a) Remove the water inlet with thermostat sub-assembly INFO.

(b) Measure the valve opening temperature of the water inlet with thermostat.

Standard value:

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80 to 84°C (176 to 183°F)

HINT:

In addition to the above check, confirm that the valve is completely closed when the temperature is below the standard.

(c) Reinstall the water inlet with thermostat sub-assembly INFO.

NG ▶ REPLACE WATER INLET WITH THERMOSTAT SUB-ASSEMBLY
OK ▶ **REPLACE ECM**

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DTC	P0136	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)
DTC	P0137	Oxygen Sensor Circuit Low Voltage (Bank 1 Sensor 2)
DTC	P0138	Oxygen Sensor Circuit High Voltage (Bank 1 Sensor 2)
DTC	P0139	Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 2)

DESCRIPTION

HINT:

Sensor 2 refers to the sensor mounted behind the three-way catalytic converter and located far from the engine assembly.

In order to obtain a high purification rate of the carbon monoxide (CO), hydrocarbons (HC) and nitrogen oxide (NOx) components in the exhaust gas, a three-way catalytic converter is used. For the most efficient use of the three-way catalytic converter, the air fuel ratio must be precisely controlled so that it is always close to the stoichiometric air fuel level. For the purpose of helping the ECM to deliver accurate air fuel ratio control, a heated oxygen sensor is used.

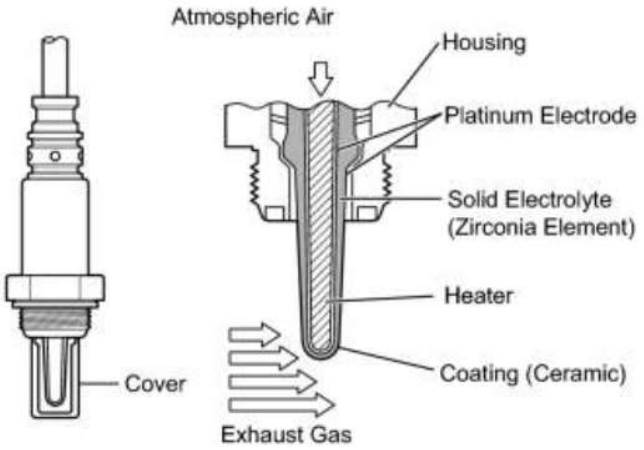
The heated oxygen sensor is located behind the three-way catalytic converter, and detects the oxygen concentration in the exhaust gas. Since the sensor is integrated with the heater that heats the sensing portion, it is possible to detect the oxygen concentration even when the intake air volume is low (the exhaust gas temperature is low).

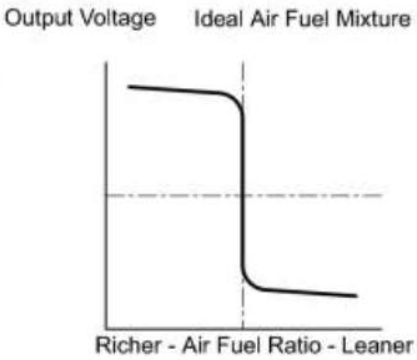
When the air fuel ratio becomes lean, the oxygen concentration in the exhaust gas is rich. The heated oxygen sensor informs the ECM that the post-three-way catalytic converter air fuel ratio is lean (low voltage, i.e. less than 0.45 V).

Conversely, when the air fuel ratio is richer than the stoichiometric air fuel level, the oxygen concentration in the exhaust gas becomes lean. The heated oxygen sensor informs the ECM that the post-three-way catalytic converter air fuel ratio is rich (high voltage, i.e. more than 0.45 V). The heated oxygen sensor has the property of changing its output voltage drastically when the air fuel ratio is close to the stoichiometric level.

The ECM uses the supplementary information from the heated oxygen sensor to determine whether the air fuel ratio after the three-way catalytic converter is rich or lean, and adjusts the fuel injection time accordingly. Thus, if the heated oxygen sensor is working improperly due to internal malfunctions, the ECM is unable to compensate for deviations in the primary air fuel ratio control.

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DTC No.	DTC Detection Condition	Trouble Area
P0136	• Abnormal voltage output: During active air fuel ratio control, following conditions (a) and (b) met for certain period of time (2 trip detection logic) (a) Heated oxygen sensor voltage does not decrease to less than 0.21 V (b) Heated oxygen sensor voltage does not increase to more than 0.59 V • Low impedance: Sensor impedance less than 5 Ω for 30 seconds or more when ECM presumes sensor to being warmed up and operating normally (2 trip detection logic)	• Open or short in heated oxygen sensor (sensor 2) circuit • Heated oxygen sensor (sensor 2) • Heated oxygen sensor heater (sensor 2) • Air fuel ratio sensor (sensor 1) • Gas leaks from exhaust system • EGR valve assembly
P0137	• Low voltage (open): During active air fuel ratio control, following conditions (a) and (b) met for certain period of time (2 trip detection logic) (a) Heated oxygen sensor voltage output less than 0.21 V (b) Target air fuel ratio rich • High impedance: Sensor impedance 15 kΩ or more for more than 90 seconds or more when ECM presumes sensor to be warmed up and operating normally (2 trip detection logic)	• Open or short in heated oxygen sensor (sensor 2) • Heated oxygen sensor (sensor 2) • Heated oxygen sensor heater (sensor 2) • Gas leak from exhaust system • EGR valve assembly

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DTC No.	DTC Detection Condition	Trouble Area
P0138	• High voltage (short): During active air fuel ratio control, following conditions (a) and (b) met for certain period of time (2 trip detection logic) (a) Heated oxygen sensor voltage output 0.59 V or more (b) Target air fuel ratio lean • Extremely high voltage (short): Heated oxygen sensor voltage output exceeds 1.2 V for 10 seconds or more (2 trip detection logic)	• Short in heated oxygen sensor (sensor 2) circuit • Heated oxygen sensor (sensor 2) • EGR valve assembly • ECM • Air fuel ratio sensor (sensor 1)
P0139	• Heated oxygen sensor (sensor 2) voltage does not drop to below 0.2 V immediately after fuel cut starts • Heated oxygen sensor (voltage does not drop from 0.35 to 0.2 V immediately after air fuel cut starts. (2 trip detection logic))	• Short in heated oxygen sensor (sensor 2) circuit • Heated oxygen sensor (sensor 2) • EGR valve assembly • ECM

for Mexico Models

DTC No.	DTC Detection Conditions	Trouble Areas
P0136	Not applicable	None
P0137	• Low voltage (open): During active air-fuel ratio control, both of the following conditions are met for a certain period of time (2 trip detection logic): (a) The Heated oxygen sensor voltage output is below 0.21 V. (b) The target air-fuel ratio is rich.	• Open in Heated oxygen sensor (sensor 2) circuit • Heated oxygen sensor (sensor 2) • Heated oxygen sensor heater (sensor 2) • Gas leak from exhaust system • EGR valve assembly
P0138	Not applicable	None
P0139	Not applicable	None

MONITOR DESCRIPTION

1. Active Air Fuel Ratio Control

The ECM usually performs air fuel ratio feedback control so that the air fuel ratio sensor output indicates a near stoichiometric air fuel level. This vehicle includes active air fuel ratio control in addition to regular air fuel ratio

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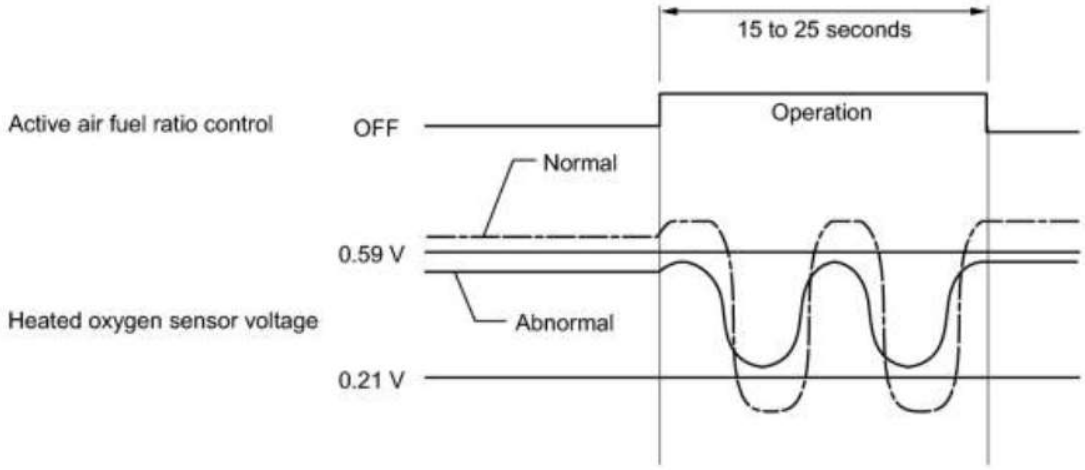
control. The ECM performs active air fuel ratio control to detect any deterioration in the three-way catalytic converter and heated oxygen sensor malfunctions (refer to the diagram below).

Active air fuel ratio control is performed for approximately 15 to 25 seconds while driving with a warm engine. During active air fuel ratio control, the air fuel ratio is forcibly regulated to become lean or rich by the ECM. If the ECM detects a malfunction, a DTC is set.

2. Abnormal Voltage Output of Heated Oxygen Sensor (DTC P0136)

While the ECM is performing active air fuel ratio control, the air fuel ratio is forcibly regulated to become rich or lean. If the sensor is not functioning properly, the voltage output variation is small. For example, when the heated oxygen sensor voltage does not decrease to less than 0.21 V or does not increase to more than 0.59 V during active air fuel ratio control, the ECM determines that the sensor voltage output is abnormal and sets DTCs P0136.

Heated Oxygen Sensor Circuit Malfunction (P0136: Abnormal Voltage)



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3. Open or Short in Heated Oxygen Sensor Circuit (DTCs P0137 or P0138)

During active air fuel ratio control, the ECM calculates the oxygen storage capacity * of the three-way catalytic converter by forcibly regulating the air fuel ratio to become rich or lean.

If the heated oxygen sensor has an open or short, or the voltage output of the sensor noticeably decreases, the oxygen storage capacity indicates an extraordinarily high value. Even if the ECM attempts to continue regulating the air fuel ratio to become rich or lean, the heated oxygen sensor output does not change.

While performing active air fuel ratio control, when the target air fuel ratio is rich and the heated oxygen sensor voltage output is less than 0.21 V (lean), the ECM interprets this as an abnormally low sensor output voltage and sets DTC P0137. When the target air fuel ratio is lean and the voltage output is 0.59 V or more (rich) during active air fuel ratio control, the ECM determines that the sensor voltage output is abnormally high, and sets DTC P0138.

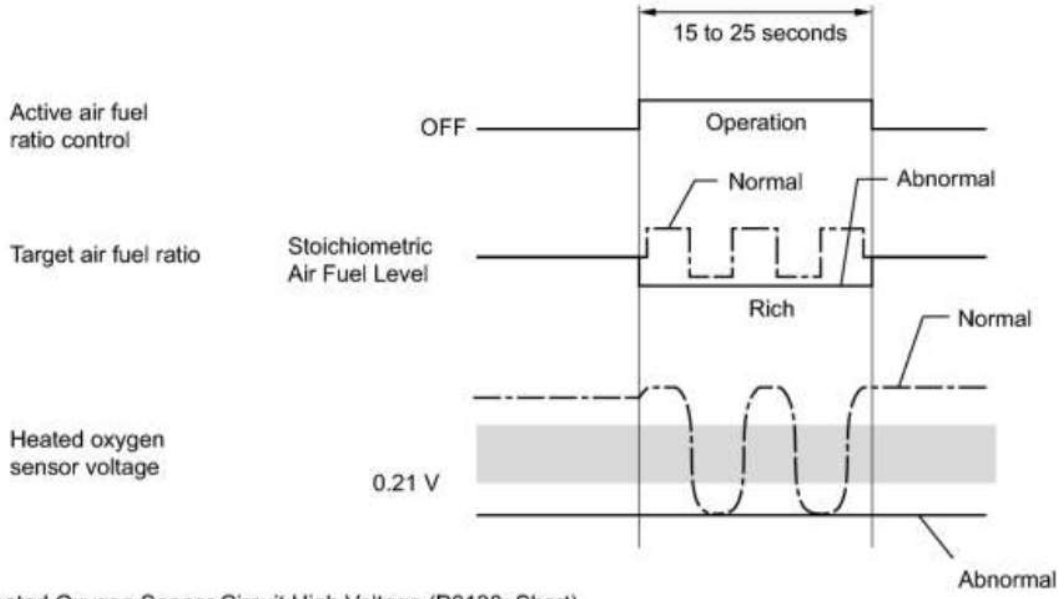
HINT:

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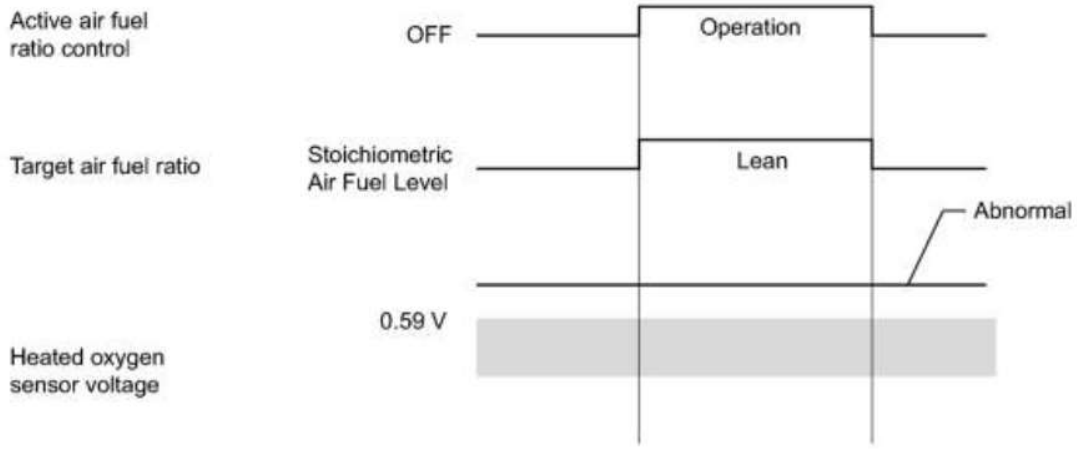
DTC P0138 is also set if the heated oxygen sensor voltage output is more than 1.2 V for 10 seconds or more.

*: The three-way catalytic converter has the capability to store oxygen. The oxygen storage capacity and the emission purification capacity of the three-way catalytic converter are mutually related. The ECM determines whether the catalyst has deteriorated, based on the calculated oxygen storage capacity value INFO.

Heated Oxygen Sensor Circuit Low Voltage (P0137: Open)



Heated Oxygen Sensor Circuit High Voltage (P0138: Short)



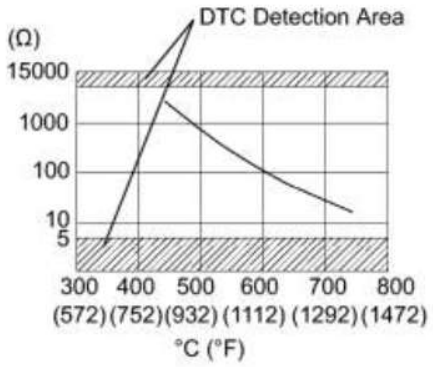
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4. High or Low Impedance of Heated Oxygen Sensor (DTCs P0136 or P0137)

During normal air fuel ratio feedback control, there are small variations in the exhaust gas oxygen concentration. In order to continuously monitor the slight variation of the heated oxygen sensor signal while the engine is running, the impedance* of the sensor is measured by the ECM. The ECM determines that there is a malfunction in the sensor when the measured

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Relationship between element temperature and impedance:



impedance deviates from the standard range.

*: The effective resistance in an alternating current electrical circuit.

- The impedance cannot be measured using an ohmmeter.
- DTC P0136 indicates the deterioration of the heated oxygen sensor. The ECM sets the DTCs by calculating the impedance of the sensor when the typical enabling conditions are satisfied (2 driving cycles).
- DTC P0137 indicates an open or short circuit in the heated oxygen sensor (2 driving cycles). The ECM sets the DTCs when the impedance of the sensor exceeds the threshold of 15 kΩ.

5. Abnormal Voltage Output of Heated Oxygen Sensor During Fuel-cut (DTC P0139)

The sensor output voltage drops to below 0.2 V (extremely lean status) immediately when the vehicle decelerates and fuel cut is operating. If the voltage does not drop to below 0.2 V for 6 seconds or more, or the voltage does not drop from 0.35 to 0.2 V for 1 second, the ECM determines that the sensor response has deteriorated, illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0136: Heated oxygen sensor output voltage (Output voltage) P0136: Heated oxygen sensor impedance (Low impedance) P0137: Heated oxygen sensor output voltage (Low voltage) P0137: Heated oxygen sensor impedance (High impedance) P0138: Heated oxygen sensor output voltage (High voltage) P0138: Heated oxygen sensor output voltage (Extremely high) P0139: Heated oxygen sensor output voltage during fuel cut
Required Sensors/Components (Main)	Heated oxygen sensor (sensor 2)
Required Sensors/Components (Related)	Crankshaft position sensor Engine coolant temperature sensor Mass air flow meter sub-assembly Throttle position sensor
Frequency of Operation	Once per driving cycle: Active air fuel ratio control detection, Heated oxygen sensor output voltage during fuel cut Continuous: Other

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Duration	20 seconds: Heated oxygen sensor output (Output voltage, High voltage, Low voltage) 30 seconds: Heated oxygen sensor impedance (Low impedance) 90 seconds: Heated oxygen sensor impedance (High impedance) 10 seconds: Heated oxygen sensor voltage (Extremely high) 6 seconds: Heated oxygen sensor voltage during fuel cut
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs not present	P0016 (VVT System Bank 1 - Misalignment) P0031, P0032, P101D (Air Fuel Ratio Sensor Heater - Sensor 1) P0037, P0038, P102D (Heated Oxygen Sensor Heater - Sensor 2) P0102, P0103 (Mass Air Flow Meter) P0107, P0108 (Manifold Absolute Pressure) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0128 (Thermostat) P0171, P0172 (Fuel System) P0301, P0302, P0303, P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0401 (EGR System (Closed)) P0451, P0452, P0453 (EVAP System)

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	P2195, P2196, P2237, P2238, P2239, P2252, P2253, P2A00 (Air Fuel Ratio Sensor - Sensor 1)

Heated Oxygen Sensor Output Voltage (Output Voltage, High Voltage and Low Voltage)

Active air fuel ratio control	Performing
Active air fuel ratio control begins when all of the following conditions are met:	-
Battery voltage	11 V or more
Engine coolant temperature	75°C (167°F) or more
Idling	OFF
Engine speed	Less than 4000 rpm
Air fuel ratio sensor status	Activated
Fuel system status	Closed loop
Fuel cut	OFF
Engine load	10 to 70%

Heated Oxygen Sensor Impedance (Low Impedance)

Battery voltage	11 V or more
Estimated sensor temperature	Less than 700°C (1292°F)
ECM monitor	Completed
DTC P0607	Not set

Heated Oxygen Sensor Impedance (High Impedance)

Battery voltage	11 V or more
Estimated sensor temperature	450 to 750°C (842 to 1382°F)
DTC P0607	Not set

Heated Oxygen Sensor Output Voltage (Extremely High)

Battery voltage	11 V or more
Time after engine start	2 seconds or more

Heated Oxygen Sensor Voltage During Fuel-cut

Engine coolant temperature	75°C (167°F) or more
Estimated catalyst temperature	400°C (752°F) or more
Fuel cut	ON

TYPICAL MALFUNCTION THRESHOLDS

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Heated Oxygen Sensor Output Voltage (Output Voltage)

Either of the following conditions is met:	1 or 2
1. All of the following conditions (a), (b) and (c) are met	-
(a) Commanded air fuel ratio	14.3 or less
(b) Heated oxygen sensor voltage	0.21 to 0.59 V
(c) Oxygen storage capacity of catalyst	2.1 g or more
2. All of the following conditions (d), (e) and (f) are met	-
(d) Commanded air fuel ratio	14.9 or more
(e) Heated oxygen sensor voltage	0.21 to 0.59 V
(f) Oxygen storage capacity of catalyst	2.1 g or more

Heated Oxygen Sensor Output Voltage (Low Voltage)

All of the following conditions (a), (b) and (c) are met	-
(a) Commanded air fuel ratio	14.3 or less
(b) Heated oxygen sensor voltage	Less than 0.21 V
(c) Oxygen storage capacity of catalyst	2.1 g or more

Heated Oxygen Sensor Output Voltage (High Voltage)

All of the following conditions (a), (b) and (c) are met	-
(a) Commanded air fuel ratio	14.9 or more
(b) Heated oxygen sensor voltage	More than 0.59 V
(c) Oxygen storage capacity of catalyst	2.1 g or more

Heated Oxygen Sensor Impedance (Low Impedance)

Duration of following condition	30 seconds or more
Heated oxygen sensor impedance	Less than 5 Ω

Heated Oxygen Sensor Impedance (High Impedance)

Duration of following condition	90 seconds or more
Heated oxygen sensor impedance	15 kΩ or more

Heated Oxygen Sensor Output Voltage (Extremely High)

Duration of following condition	10 seconds or more
Heated oxygen sensor output voltage	1.2 V or more

Heated Oxygen Sensor Voltage During Fuel-cut

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One of the following conditions is set	-
Duration until rear heated oxygen sensor voltage drops to 0.2 V during fuel cut	6 seconds or more
Duration that rear heated oxygen sensor voltage drops from 0.35 to 0.2 V during fuel cut	1 second or more

COMPONENT OPERATING RANGE

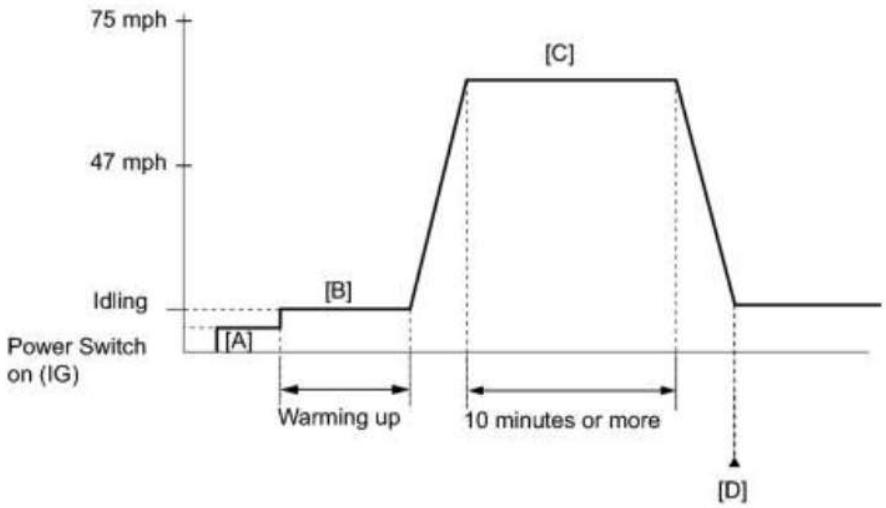
Duration of following condition	30 seconds or more
Heated oxygen sensor voltage	Varies between 0.1 V and 0.9 V

MONITOR RESULT

Refer to Checking Monitor Status INFO.

CONFIRMATION DRIVING PATTERN

P0136, P0137 and P0138



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher [B].
8. Drive the vehicle at 47 to 75 mph (75 to 120 km/h) for 10 minutes or more [C].
9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
10. Read the pending DTC [D].

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11. If a pending DTC is output, the system is malfunctioning.

    HINT:

    If a pending DTC is not output, perform the following procedure.

12. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
13. Input the DTC: P0136, P0137 or P0138.
14. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

    CAUTION:

    When performing the confirmation driving pattern, obey all speed limits and traffic laws.

    HINT:

    - If the judgment result shows ABNORMAL, the system has a malfunction.
    - If the judgment result shows NORMAL, the system is normal.
    - If the judgment result shows INCOMPLETE or UNKNOWN, perform step [C] again.

15. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
16. Check the judgment result.

    HINT:

    - If the judgment result shows ABNORMAL, the system has a malfunction.
    - If the judgment result shows NORMAL, the system is normal.

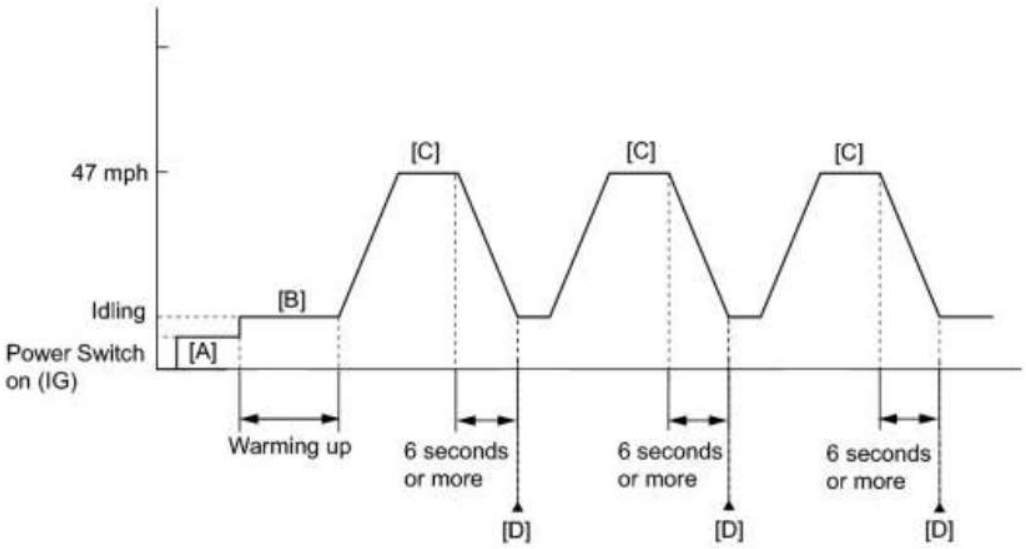
17. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

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P0139



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher [B].
8. Drive the vehicle at 47 mph (75 km/h), and then decelerate the vehicle by releasing the accelerator pedal for 6 seconds or more to perform the fuel-cut [C].
9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
10. Read the pending DTC [D].
11. If a pending DTC is output, the system is malfunctioning.

    HINT:

    If a pending DTC is not output, perform the following procedure.

12. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
13. Input the DTC: P0139.
14. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed

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Techstream Display	Description
	○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, move the shift lever to B and then perform step [C] again.

15. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
16. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

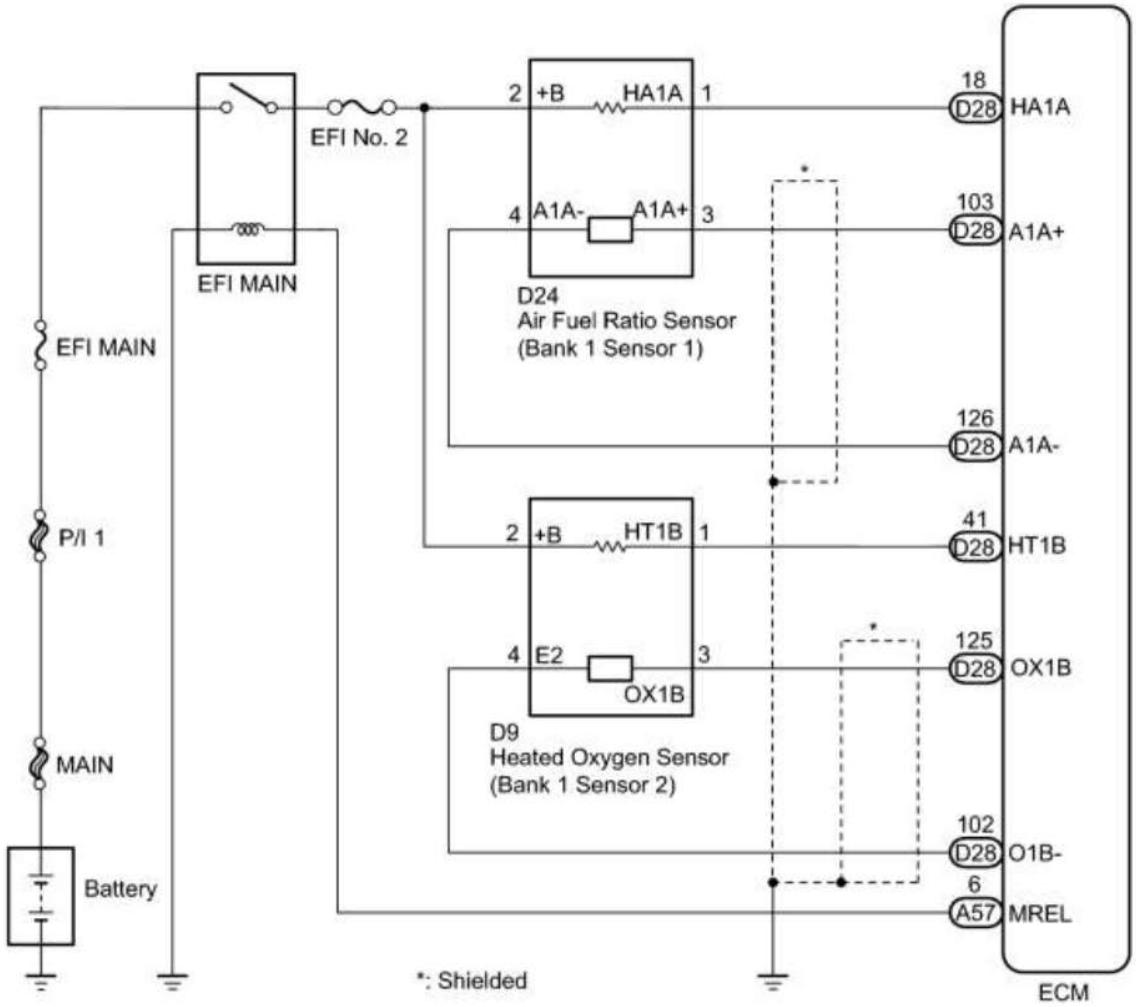
17. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

HINT:

Malfunctioning areas can be identified by performing the Control the Injection Volume for A/F Sensor function provided in the Active Test. The Control the Injection Volume for A/F Sensor function can help to determine whether the air fuel ratio sensor, heated oxygen sensor and other potential trouble areas are malfunctioning.

The following instructions describe how to conduct the Control the Injection Volume for A/F Sensor operation using the Techstream.

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Put the engine in inspection mode INFO.
4. Start the engine.
5. Warm up the engine at an engine speed of 2500 rpm for approximately 90 seconds.

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6. Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor.
7. Perform the Active Test operation with the engine in an idling condition (press the RIGHT or LEFT button to change the fuel injection volume).
8. Monitor the voltage outputs of the air fuel ratio and heated oxygen sensors (AFS Voltage B1S1 and O2S B1S2) displayed on the Techstream.

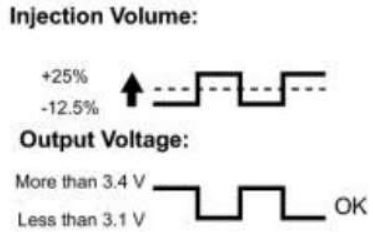
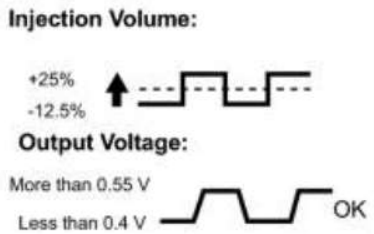
HINT:

- The Control the Injection Volume for A/F Sensor operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

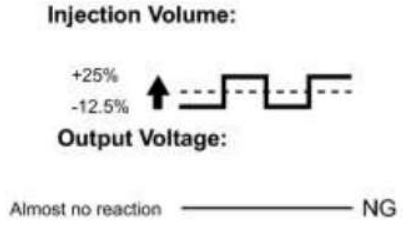
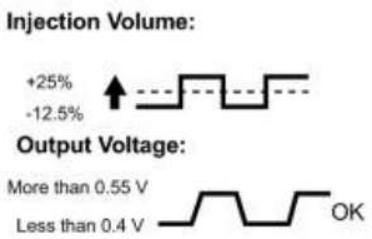
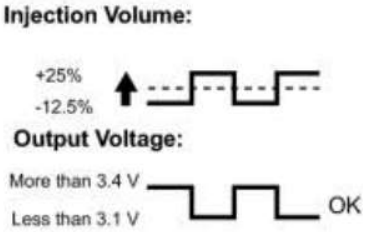
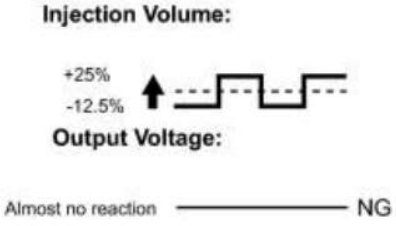
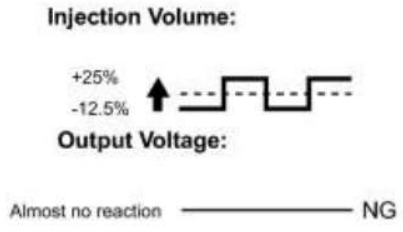
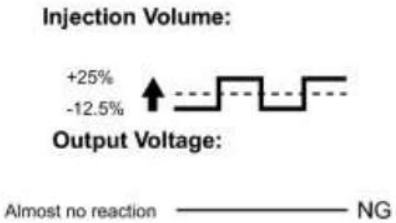
Techstream Display (Sensor)	Injection Volume	Status	Voltage
AFS Voltage B1S1 (Air fuel ratio)	+25%	Rich	Less than 3.1 V
AFS Voltage B1S1 (Air fuel ratio)	-12.5%	Lean	More than 3.4 V
O2S B1S2 (Heated oxygen)	+25%	Rich	More than 0.55 V
O2S B1S2 (Heated oxygen)	-12.5%	Lean	Less than 0.4 V

NOTICE:

The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

Case	Air Fuel Ratio Sensor (Sensor 1) Output Voltage	Heated Oxygen Sensor (Sensor 2) Output Voltage	Main Suspected Trouble Area
1			-
2			○ Air fuel ratio sensor ○ Air fuel ratio sensor heater ○ Air fuel ratio sensor

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Case	Air Fuel Ratio Sensor (Sensor 1) Output Voltage	Heated Oxygen Sensor (Sensor 2) Output Voltage	Main Suspected Trouble Area
			circuit
3			○ Heated oxygen sensor ○ Heated oxygen sensor heater ○ Heated oxygen sensor circuit ○ Exhaust gas leaks
4			○ Fuel pressure ○ Exhaust gas leaks (Air fuel ratio extremely lean or rich)

- Following the Control the Injection Volume for A/F Sensor procedure enables technicians to check and graph the voltage outputs of both the air fuel ratio and heated oxygen sensors.
- To display the graph, enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor / A/F Control System / AFS Voltage B1S1 and O2S B1S2.

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

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- If the OX1B wire from the ECM connector is short-circuited to the +B wire, DTC P0136 will be set.

PROCEDURE

1.	READ DTC OUTPUT (DTC P0136, P0137, P0138 OR P0139)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result:

Result	Proceed to
DTC P0138 is output	A
DTC P0137 is output	B
DTC P0136 is output	C
DTC P0139 is output	D

D ▶ READ VALUE USING TECHSTREAM
C ▶ READ VALUE USING TECHSTREAM (OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR)
B ▶ CHECK EXHAUST GAS LEAK
A ▼

2.	READ VALUE USING TECHSTREAM (OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / A/F Control System / O2S B1S2.

(e) Allow the engine to idle.

(f) Read the heated oxygen sensor output voltage while idling.

Result:

Result	Proceed to
1.0 V or more	A

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Result	Proceed to
Less than 1.0 V	B

B ▶ PERFORM ACTIVE TEST USING TECHSTREAM (INJECTION VOLUME)

A ▼

3.	INSPECT HEATED OXYGEN SENSOR (CHECK FOR SHORT)

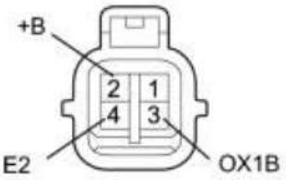
(a) Disconnect the heated oxygen sensor connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

*1

Tester Connection	Condition	Specified Condition
2 (+B) - 4 (E2)	Always	10 kΩ or higher
2 (+B) - 3 (OX1B)		



Text in Illustration

*1	Component without harness connected (Heated Oxygen Sensor)

(c) Reconnect the heated oxygen sensor connector.

NG ▶ REPLACE HEATED OXYGEN SENSOR

OK ▼

4.	CHECK HARNESS AND CONNECTOR

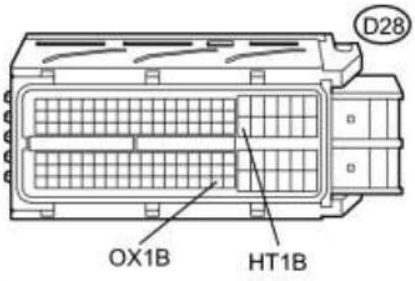
(a) Turn the power switch off and wait for 5 minutes or more.

(b) Disconnect the ECM connector.

*1

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Short):



N

Tester Connection	Condition	Specified Condition
D28-41 (HT1B) - D28-125 (OX1B)	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to ECM)

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(d) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (HEATED OXYGEN SENSOR - ECM)

OK ▼

5.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	**0 to 30 Steps**
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

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HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

NG ▶ INSPECT EGR VALVE ASSEMBLY
OK ▶ REPLACE ECM

6.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

NG ▶ REPLACE EGR VALVE ASSEMBLY
OK ▶ **REPLACE ECM**

7.	PERFORM ACTIVE TEST USING TECHSTREAM (INJECTION VOLUME)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume.

(g) Change the fuel injection volume using the Techstream and monitor the voltage output of air fuel ratio and heated oxygen sensors displayed on the Techstream.

HINT:

- Change the fuel injection volume within the range of -12% and +12%. The injection volume can be changed in 1% graduations within the range.
- The air fuel ratio sensor is displayed as AFS Voltage B1S1, and the heated oxygen sensor is displayed as O2S B1S2 on the Techstream.
- The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

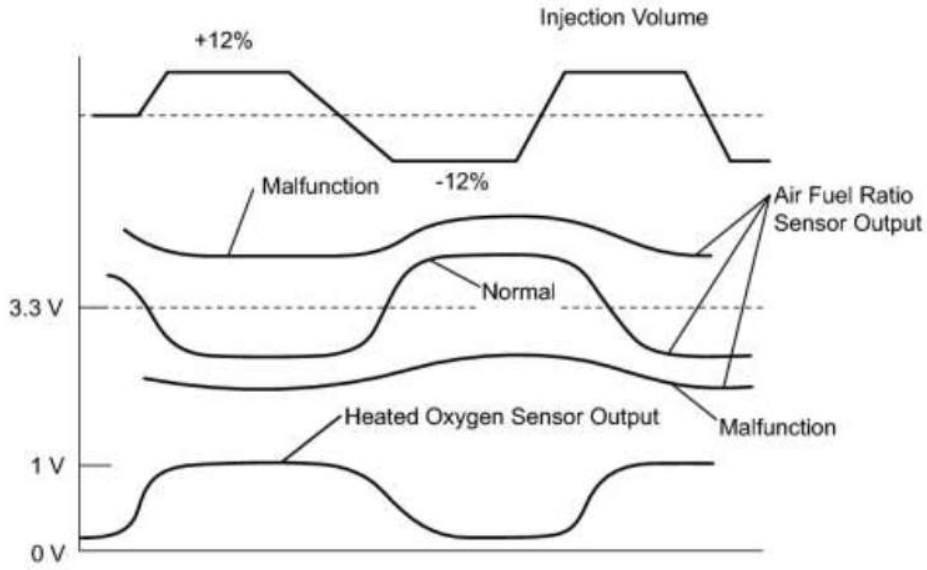
Result:

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Techstream Display (Sensor)	Voltage Variation	Proceed to
AFS Voltage B1S1 (Air fuel ratio)	Alternates between more and less than 3.3 V	OK
	Remains at more than 3.3 V	NG
	Remains at less than 3.3 V	NG

HINT:

A normal heated oxygen sensor voltage (O2S B1S2) reacts in accordance with increases and decreases in fuel injection volumes. When the air fuel ratio sensor voltage remains at either less or more than 3.3 V despite the heated oxygen sensor indicating a normal reaction, the air fuel ratio sensor is malfunctioning.



NG ▶ REPLACE AIR FUEL RATIO SENSOR

OK ▼

8.	INSPECT AIR FUEL RATIO SENSOR

HINT:

This air fuel ratio sensor test is to check the air fuel ratio sensor current during the fuel-cut. When the sensor is normal, the sensor current will indicate below 3.0 mA in this test.

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Drive the vehicle according to the drive pattern listed below:

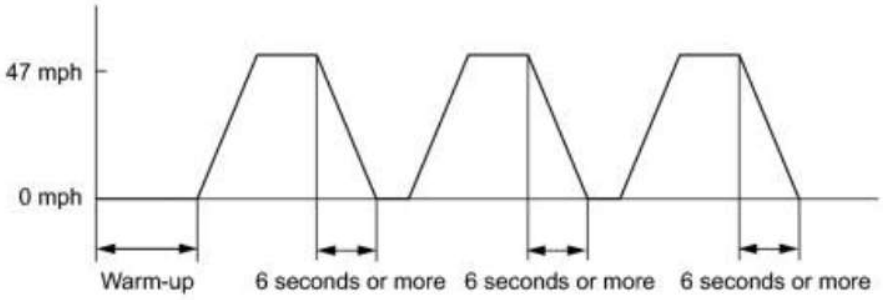
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(1) Put the engine in inspection mode INFO.

(2) Warm up the engine until the engine coolant temperature reaches 75°C (167°F) or more.

(3) Drive the vehicle at 47 mph (75 km/h) or more and decelerate the vehicle for 6 seconds or more.

(4) Repeat the deceleration above at least 3 times.



(f) Enter the following menus: Powertrain / Engine and ECT / Monitor / O2 Sensor / Details.

(g) Confirm that RANGE B1S1 is either Pass or Fail. If the Techstream shows Incomplete, re-check RANGE B1S1 after performing the drive pattern.

(h) Select the RANGE B1S1.

(i) Read the Test Value.

Standard current:

Less than 3.0 mA

HINT:

If the Techstream shows Incomplete again, add the vehicle speed and move the shift lever to B to decelerate the vehicle.

NG ▶ REPLACE AIR FUEL RATIO SENSOR
OK ▶ REPLACE HEATED OXYGEN SENSOR

9.	READ VALUE USING TECHSTREAM (OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

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(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume.

(g) Change the fuel injection volume using the Techstream and monitor the voltage output of heated oxygen sensor displayed on the Techstream.

HINT:

- Change the fuel injection volume within the range of -12% and +12%. The injection volume can be changed in 1% graduations within the range.
- The heated oxygen sensor is displayed as O2S B1S2 on the Techstream.
- The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

Standard:

Fluctuates between 0.4 V or less and 0.55 V or more.

NG ▶ CHECK EXHAUST GAS LEAK

OK ▼

10.	PERFORM ACTIVE TEST USING TECHSTREAM (INJECTION VOLUME)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume.

(g) Change the fuel injection volume using the Techstream and monitor the voltage output of air fuel ratio and heated oxygen sensors displayed on the Techstream.

HINT:

- Change the fuel injection volume within the range of -12% and +12%. The injection volume can be changed in 1% graduations within the range.
- The air fuel ratio sensor is displayed as AFS Voltage B1S1, and the heated oxygen sensor is displayed as O2S B1S2 on the Techstream.
- The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

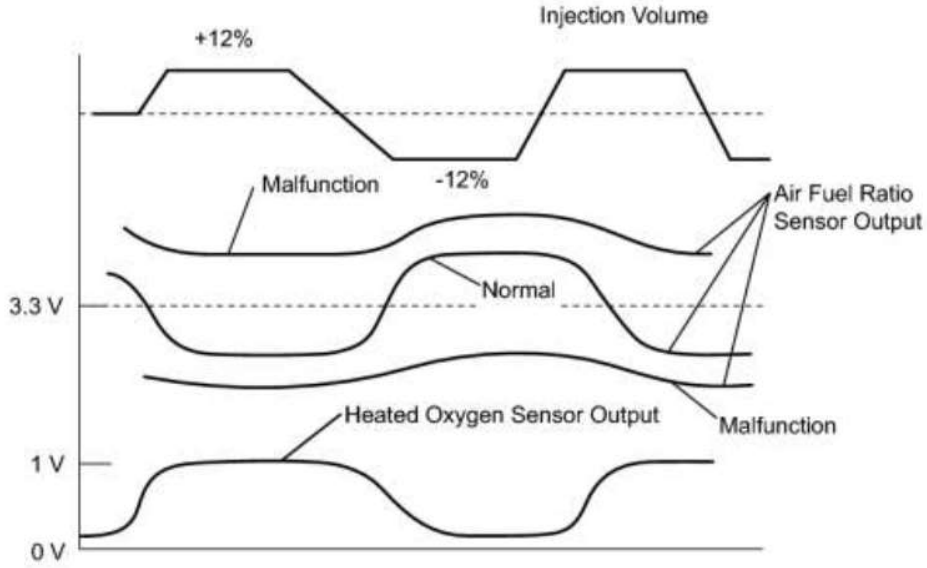
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Result:

Techstream Display (Sensor)	Voltage Variation	Proceed to
AFS Voltage B1S1 (Air fuel ratio)	Alternates between more and less than 3.3 V	OK
	Remains at more than 3.3 V	NG
	Remains at less than 3.3 V	NG

HINT:

A normal heated oxygen sensor voltage (O2S B1S2) reacts in accordance with increases and decreases in fuel injection volumes. When the air fuel ratio sensor voltage remains at either less or more than 3.3 V despite the heated oxygen sensor indicating a normal reaction, the air fuel ratio sensor is malfunctioning.



NG ▶ REPLACE AIR FUEL RATIO SENSOR

OK ▼

11.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

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(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

NG ▶ INSPECT EGR VALVE ASSEMBLY

OK ▶ CHECK EXTREMELY RICH OR LEAN ACTUAL AIR FUEL RATIO AND REPAIR CAUSE (FUEL INJECTOR ASSEMBLY, FUEL PRESSURE, GAS LEAK FROM SYSTEM)

12.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

NG ▶ REPLACE EGR VALVE ASSEMBLY

OK ▶ **CHECK EXTREMELY RICH OR LEAN ACTUAL AIR FUEL RATIO AND REPAIR CAUSE**

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(FUEL INJECTOR ASSEMBLY, FUEL PRESSURE, GAS LEAK FROM SYSTEM)

13.	CHECK EXHAUST GAS LEAK

(a) Inspect for exhaust gas leaks from the exhaust manifold sub-assembly and exhaust pipes.

OK:

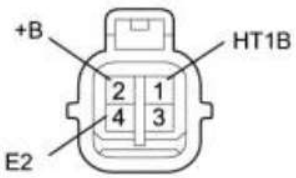
No gas leaks.

NG ▶ REPAIR OR REPLACE EXHAUST GAS LEAK POINT

OK ▼

14.	INSPECT HEATED OXYGEN SENSOR (HEATER RESISTANCE)

*1



(a) Disconnect the heated oxygen sensor connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
1 (HT1B) - 2 (+B)	20°C (68°F)	11 to 16 Ω
1 (HT1B) - 4 (E2)	Always	10 kΩ or higher

Text in Illustration

*1	Component without harness connected (Heated Oxygen Sensor (Sensor 2))

(c) Reconnect the heated oxygen sensor connector.

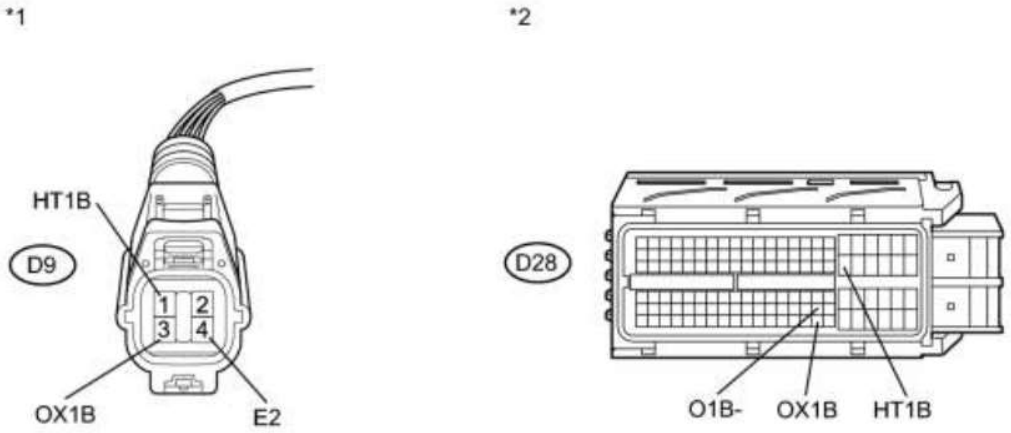
NG ▶ REPLACE HEATED OXYGEN SENSOR

OK ▼

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15.	CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR - ECM)

(a) Disconnect the heated oxygen sensor connector.



(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D9-1 (HT1B) - D28-41 (HT1B)	Always	Below 1 Ω
D9-3 (OX1B) - D28-125 (OX1B)		
D9-4 (E2) - D28-102 (O1B-)		

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D9-1 (HT1B) or D28-41 (HT1B) - Body ground	Always	10 kΩ or higher
D9-3 (OX1B) or D28-125 (OX1B) - Body ground		

Text in Illustration

*1	Front view of wire harness connector (to Heated Oxygen Sensor)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the heated oxygen sensor connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (HEATED OXYGEN SENSOR - ECM)

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OK

16.	REPLACE HEATED OXYGEN SENSOR

(a) Replace the heated oxygen sensor INFO.

NEXT

17.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTC INFO.

(e) Turn the Techstream off.

(f) Turn the power switch off and wait for 30 seconds.

(g) Turn the power switch on (IG) and turn the Techstream on.

(h) Put the engine in inspection mode INFO.

(i) Start the engine and warm it up.

(j) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern for P0136, P0137or P0138.

NEXT

18.	CHECK WHETHER DTC OUTPUT RECURS (P0136, P0137 OR P0138)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(e) Input the DTCs: P0136, P0137 and P0138. Check the DTC judgement result is NORMAL. If it is INCOMPLETE, perform the drive pattern adding the vehicle speed.

Result:

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Result	Proceed to
ABNORMAL (DTC P0136, P0137 or P0138 is output)	A
NORMAL (DTC is not output)	B

B ▶ END

A ▼

19.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling

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-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

NG ▶ INSPECT EGR VALVE ASSEMBLY
OK ▶ REPLACE AIR FUEL RATIO SENSOR

20.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

NG ▶ REPLACE EGR VALVE ASSEMBLY
OK ▶ **REPLACE AIR FUEL RATIO SENSOR**

21.	REPLACE AIR FUEL RATIO SENSOR

(a) Replace the air fuel ratio sensor INFO.

NEXT ▼

22.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTC INFO.

(e) Turn the Techstream off.

(f) Turn the power switch off and wait for 30 seconds.

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(g) Turn the power switch on (IG) and turn the Techstream on.

(h) Put the engine in inspection mode INFO.

(i) Start the engine and warm it up.

(j) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern for P0136, P0137or P0138.

NEXT

23.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0136 OR P0138)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(e) Input the DTCs: P0136 or P0138. Check the DTC judgement result is NORMAL. If it is INCOMPLETE, perform the drive pattern adding the vehicle speed.

Result:

Result	Proceed to
ABNORMAL (DTC P0136 or P0138 is output)	A
NORMAL (DTC is not output)	B

B END

A

24.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

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HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

NG ▶ INSPECT EGR VALVE ASSEMBLY
OK ▶ REPLACE HEATED OXYGEN SENSOR

25.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

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NG ▶ REPLACE EGR VALVE ASSEMBLY
OK ▶ **REPLACE HEATED OXYGEN SENSOR**

26.	READ VALUE USING TECHSTREAM

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / A/F Control System / O2S B1S2.

(e) Allow the engine to idle.

(f) Read the heated oxygen sensor output voltage while idling.

Result:

Result	Proceed to
1.0 V or more	A
Less than 1.0 V	B

B ▶ READ DTC OUTPUT (DTC P0139 IS OUTPUT AGAIN)

A ▼

27.	INSPECT HEATED OXYGEN SENSOR

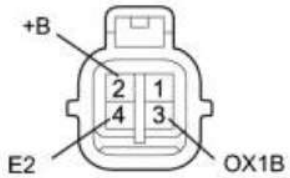
(a) Disconnect the heated oxygen sensor connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

*1

Tester Connection	Condition	Specified Condition
2 (+B) - 4 (E2)	Always	10 kΩ or higher
2 (+B) - 3 (OX1B)		



Text in Illustration

*1	Component without harness connected (Heated Oxygen Sensor)

(c) Reconnect the heated oxygen sensor connector.

NG ▶ REPLACE HEATED OXYGEN SENSOR

OK ▼

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28.	CHECK HARNESS OR CONNECTOR (CHECK FOR SHORT)

(a) Turn the power switch off and wait for 5 minutes or more.

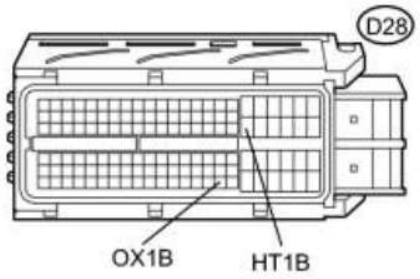
(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D28-41 (HT1B) - D28-125 (OX1B)	Always	10 kΩ or higher

*1



N

Text in Illustration

*1	Front view of wire harness connector (to ECM)

(d) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (HEATED OXYGEN SENSOR - ECM)

OK ▶ **REPLACE ECM**

29.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.

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- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	**0 to 30 Steps**
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

NG ▶ INSPECT EGR VALVE ASSEMBLY
OK ▶ REPLACE ECM

30.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

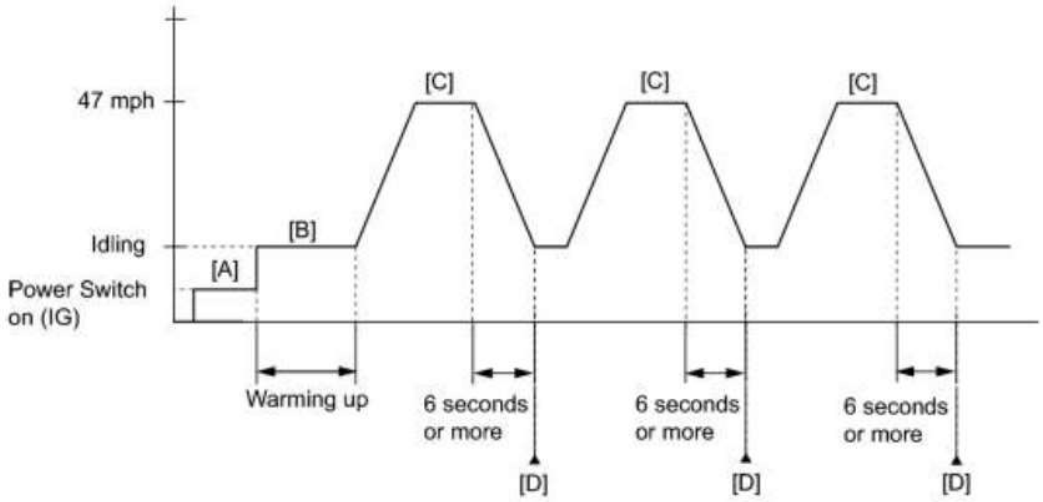
EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

NG ▶ REPLACE EGR VALVE ASSEMBLY
OK ▶ **REPLACE ECM**

31.	READ DTC OUTPUT (DTC P0139 IS OUTPUT AGAIN)

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(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG) and turn the Techstream on.

(c) Clear the DTC (even if no DTC are stored, perform the clear DTC procedure) INFO.

(d) Turn the power switch off and wait for 30 seconds.

(e) Turn the power switch on (IG) and turn the Techstream on [A].

(f) Put the engine in inspection mode INFO.

(g) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more [B].

(h) Drive the vehicle at 47 mph (75 km/h), and then decelerate the vehicle by releasing the accelerator pedal for 6 seconds or more to perform the fuel cut [C].

(i) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(j) Input DTC: P0139. Check the DTC Monitor is NORMAL. If DTC Monitor is INCOMPLETE, perform the drive pattern increasing the vehicle speed and move the shift lever in B to decelerate the vehicle.

Result:

Result	Proceed to
ABNORMAL (DTC P0139 is output)	A

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Result	Proceed to
NORMAL (DTC is not output)	B

B ▶ CHECK FOR INTERMITTENT PROBLEMS

A ▼

32.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

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-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
	(EGR valve is fully closed)	

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

NG ▶ INSPECT EGR VALVE ASSEMBLY
OK ▶ REPLACE HEATED OXYGEN SENSOR

33.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

NG ▶ REPLACE EGR VALVE ASSEMBLY
OK ▶ **REPLACE HEATED OXYGEN SENSOR**

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DTC	P0171	System Too Lean (Bank 1)
DTC	P0172	System Too Rich (Bank 1)

DESCRIPTION

The fuel trim is related to the feedback compensation value, not to the basic injection duration. The fuel trim consists of both the short-term and long-term fuel trim.

The short-term fuel trim is fuel compensation that is used to constantly maintain the air fuel ratio at stoichiometric levels. The signal from the air fuel ratio sensor indicates whether the air fuel ratio is rich or lean compared to the stoichiometric ratio. This triggers a reduction in the fuel injection volume if the air fuel ratio is rich and an increase in the fuel injection volume if it is lean.

Factors such as individual engine differences, wear over time and changes in operating environment cause short-term fuel trim to vary from the central value. The long-term fuel trim, which controls overall fuel compensation, compensates for long-term deviations in the fuel trim from the central value caused by the short-term fuel trim compensation.

If both the short-term and long-term fuel trim are lean or rich beyond predetermined values, it is interpreted as a malfunction, and the ECM illuminates the MIL and sets a DTC.

DTC No.	DTC Detection Condition	Trouble Area
P0171	With warm engine and stable air fuel ratio feedback, fuel trim considerably in error to lean side (2 trip detection logic)	• Intake system • Fuel injector assembly • Mass air flow meter sub-assembly • Engine coolant temperature sensor • Fuel pressure • Gas leaks from exhaust system • Open or short in air fuel ratio sensor (sensor 1) circuit • Air fuel ratio sensor (sensor 1) • PCV valve and hose • PCV hose connections • EGR valve assembly • ECM
P0172	With warm engine and stable air fuel ratio feedback, fuel trim considerably in error to rich side (2 trip detection logic)	• Fuel injector assembly • Mass air flow meter sub-assembly • Engine coolant temperature sensor • Ignition system • Fuel pressure • Gas leaks from exhaust system • Open or short in air fuel ratio sensor (sensor 1) circuit • Air fuel ratio sensor (sensor 1) • EGR valve assembly • ECM

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HINT:

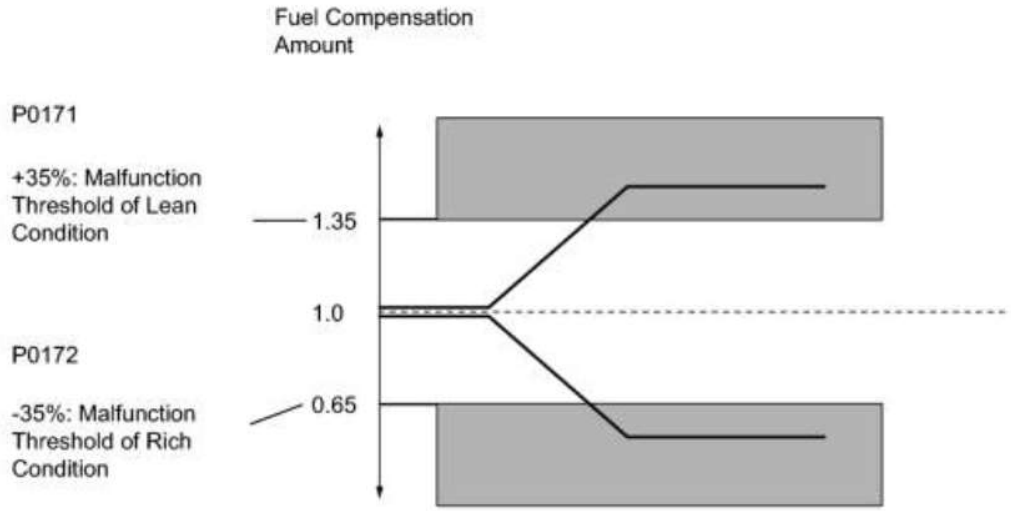
- When DTC P0171 is set, the actual air fuel ratio is on the lean side. When DTC P0172 is set, the actual air fuel ratio is on the rich side.
- If the vehicle runs out of fuel, the air fuel ratio is lean and DTC P0171 may be set. The MIL then illuminates.
- When the total of the short-term and long-term fuel trim values is within the malfunction threshold (and the engine coolant temperature is more than 75°C (167°F)), the system is functioning normally.

MONITOR DESCRIPTION

Under closed-loop fuel control, a fuel injection volume that deviates from that estimated by the ECM causes changes in the long-term fuel trim compensation value. The long-term fuel trim is adjusted when there are persistent deviations in the short-term fuel trim value. Deviations from the ECM's estimated fuel injection volume also affect the average fuel trim learning value, which is a combination of the average short-term fuel trim (fuel feedback compensation value) and the average long-term fuel trim (learning value of the air fuel ratio). If the average fuel trim learning value exceeds a malfunction threshold, the ECM interprets this a fault in the fuel system and sets a DTC.

Example:

The average fuel trim learning value is +35% or more or -35% or less, the ECM interprets this as a fuel system malfunction.



MONITOR STRATEGY

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Related DTCs	P0171: Fuel trim Lean (bank 1) P0172: Fuel trim Rich (bank 1)
Required Sensors/Components (Main)	Fuel system
Required Sensors/Components (Related)	Air fuel ratio sensor Mass air flow meter sub-assembly Crankshaft position sensor
Frequency of Operation	Continuous
Duration	Within 10 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Fuel-trim

Monitor runs whenever following DTCs are not present	P0010 (VVT Oil Control Valve Bank 1) P0011 (VVT System Bank 1- Advance) P0012 (VVT System Bank 1- Retard) P0016 (VVT System Bank 1 - Misalignment) P0031, P0032, P101D (Air Fuel Ratio Sensor Heater - Sensor 1) P0102, P0103 (Mass Air Flow Meter) P0107, P0108 (Manifold Absolute Pressure) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0335 (Crankshaft Position Sensor) P0340, P0342, P0343 (Camshaft Position Sensor) P0351, P0352, P0353, P0354 (Igniter) P0401 (EGR System (Closed))
Fuel system status	Closed-loop

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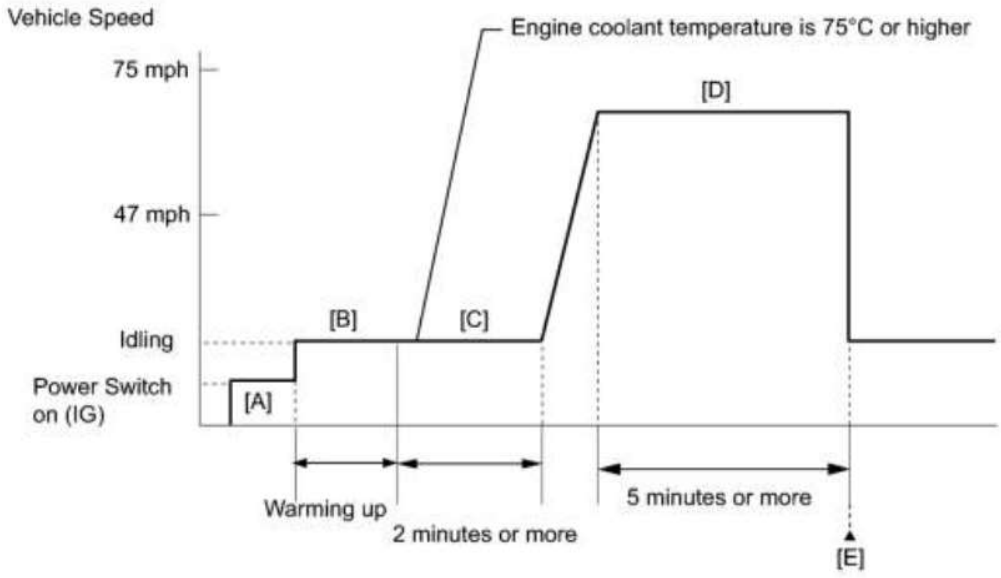
Battery voltage	11 V or more
Either of the following conditions 1 or 2 is set	-
1. Engine speed	Less than 1100 rpm
2. Intake air amount per revolution	0.12 g/rev or more
Catalyst monitor	Not executed

TYPICAL MALFUNCTION THRESHOLDS

Fuel-trim

Purge-cut	Executing
Either of the following conditions 1 or 2 is met	-
1. Average between short-term fuel trim and long-term fuel trim	35% or more (varies with engine coolant temperature)
2. Average between short-term fuel trim and long-term fuel trim	-35% or less (varies with engine coolant temperature)

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.

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7. Start the engine and warm it up (until the engine coolant temperature is 75°C (167°F) or higher) with all the accessories switched off [B].
8. With the engine warmed up, idle the engine for 2 minutes or more [C].
9. Drive the vehicle at between 47 and 75 mph (75 and 120 km/h) and at an engine speed of between 1400 and 3200 rpm for 5 minutes or more [D].
10. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
11. Read the pending DTC [E].
12. If a pending DTC is output, the system is malfunctioning.

HINT:

If a pending DTC is not output, perform the following procedure.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Input the DTC: P0171 or P0172.
15. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

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CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [C] through [D] again.

16. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
17. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

18. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P2195 INFO.

INSPECTION PROCEDURE

HINT:

Malfunctioning areas can be identified by performing the Control the Injection Volume for A/F Sensor in the Active Test. The Control the Injection Volume for A/F Sensor function can help to determine whether the air fuel ratio sensor, heated oxygen sensor and other potential trouble areas are malfunctioning.

The following instructions describe how to conduct the Control the Injection Volume for A/F Sensor operation using the Techstream.

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Put the engine in inspection mode INFO.
4. Start the engine.
5. Warm up the engine at an engine speed of 2500 rpm for approximately 90 seconds.
6. Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor.
7. Perform the Active Test operation with the engine idling (press the RIGHT or LEFT button to change the fuel injection volume).
8. Monitor the voltage outputs of the air fuel ratio and heated oxygen sensors (AFS Voltage B1S1 and O2S B1S2) displayed on the Techstream.

    HINT:

    - The Control the Injection Volume for A/F Sensor operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
    - Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

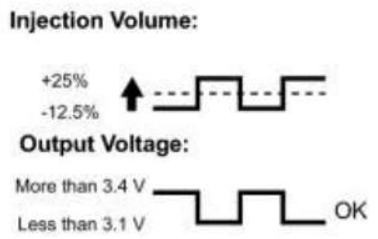
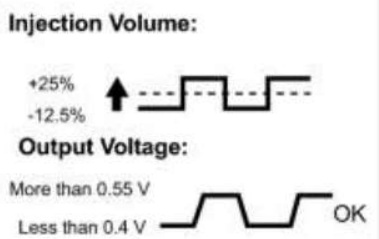
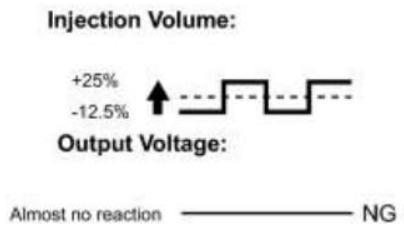
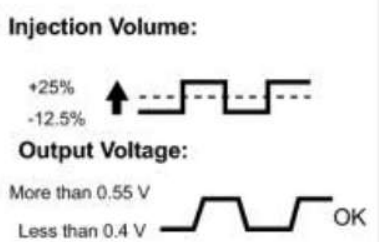
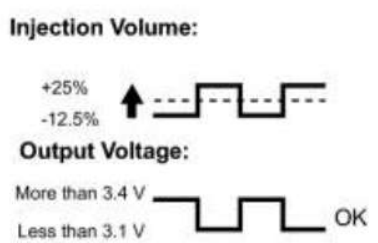
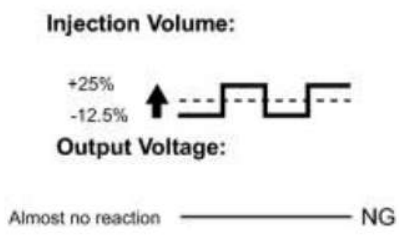
Techstream Display (Sensor)	Injection Volume	Status	Voltage
AFS Voltage B1S1 (Air fuel ratio)	+25%	Rich	Less than 3.1 V
AFS Voltage B1S1 (Air fuel ratio)	-12.5%	Lean	More than 3.4 V

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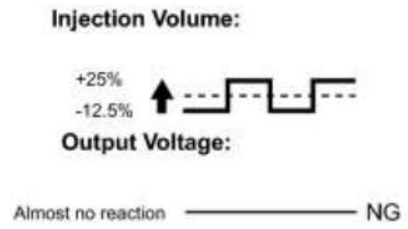
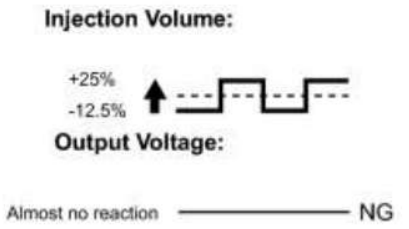
Techstream Display (Sensor)	Injection Volume	Status	Voltage
O2S B1S2 (Heated oxygen)	+25%	Rich	More than 0.55 V
O2S B1S2 (Heated oxygen)	-12.5%	Lean	Less than 0.4 V

NOTICE:

The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

Case	Air Fuel Ratio Sensor (Sensor 1) Output Voltage	Heated Oxygen Sensor (Sensor 2) Output Voltage	Main Suspected Trouble Area
1			-
2			○ Air fuel ratio sensor ○ Air fuel ratio sensor heater ○ Air fuel ratio sensor circuit
3			○ Heated oxygen sensor ○ Heated oxygen sensor heater ○ Heated oxygen sensor circuit ○ Exhaust gas leaks
4			○ Fuel pressure ○ Exhaust gas leaks (Air fuel ratio extremely lean or rich)

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Case	Air Fuel Ratio Sensor (Sensor 1) Output Voltage	Heated Oxygen Sensor (Sensor 2) Output Voltage	Main Suspected Trouble Area
			

- Following the Control the Injection Volume for A/F Sensor procedure enables technicians to check and graph the voltage outputs of both the air fuel ratio and heated oxygen sensors.
- To display the graph, enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor / A/F Control System / AFS Voltage B1S1 and O2S B1S2.

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- A low air fuel ratio sensor voltage could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.
- A high air fuel ratio sensor voltage could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0171 OR P0172)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

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Result:

Result	Proceed to
DTC P0171 or P0172 is output	A
DTC P0171 or P0172 and other DTCs are output	B

HINT:

If any DTCs other than P0171 or P0172 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK PCV HOSE CONNECTIONS

(a) Inspect the PCV hose connections.

OK:

PCV hose is connected correctly and is not damaged.

NG ▶ REPAIR OR REPLACE PCV HOSE

OK ▼

3.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO.

OK:

No leaks in intake system.

NG ▶ REPAIR OR REPLACE INTAKE SYSTEM

OK ▼

4.	PERFORM ACTIVE TEST USING TECHSTREAM (AIR FUEL RATIO CONTROL)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG) and turn the Techstream on.

(c) Put the engine in inspection mode INFO.

(d) Start the engine.

(e) Warm up the engine at an engine speed of 2500 rpm for approximately 90 seconds.

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(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor.

(g) Perform the Control the Injection Volume for A/F Sensor operation with the engine idling (press the RIGHT or LEFT button to change the fuel injection volume).

(h) Monitor the voltage outputs of the air fuel ratio sensor and the heated oxygen sensor (AFS Voltage B1S1 and O2S B1S2) displayed on the Techstream.

HINT:

- The Control the Injection Volume for A/F Sensor operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.
- The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

Standard:

Techstream Display (Sensor)	Injection Volume	Status	Voltage
AFS Voltage B1S1 (air fuel ratio)	+25%	Rich	Less than 3.1 V
	-12.5%	Lean	More than 3.4 V
O2S B1S2 (heated oxygen)	+25%	Rich	More than 0.55 V
	-12.5%	Lean	Less than 0.4 V

Result

Status AFS Voltage B1S1	Status O2S B1S2	Air Fuel Ratio Condition and Air Fuel Ratio Sensor Condition	Misfire	Suspected Trouble Area	Proceed to
Lean/Rich	Lean/Rich	Normal	-	-	C
Lean	Lean	Actual air fuel ratio lean	May occur	• PCV valve and hose • PCV hose connections • Fuel injector assembly blockage • Gas leaks from exhaust system • Intake system • Fuel pressure • Mass air flow meter sub-assembly • Engine coolant temperature	A

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Status AFS Voltage B1S1	Status O2S B1S2	Air Fuel Ratio Condition and Air Fuel Ratio Sensor Condition	Misfire	Suspected Trouble Area	Proceed to
				sensor	
Rich	Rich	Actual air fuel ratio rich	-	• Fuel injector assembly leakage or blockage • Gas leaks from exhaust system • Ignition system • Fuel pressure • Mass air flow meter sub-assembly • Engine coolant temperature sensor	
Lean	Lean/Rich	Air fuel ratio sensor malfunction	-	Air fuel ratio sensor	B
Rich	Lean/Rich	Air fuel ratio sensor malfunction	-	Air fuel ratio sensor	

Lean: During Control the Injection Volume for A/F Sensor, the air fuel ratio sensor output voltage (AFS Voltage) is consistently more than 3.4 V, and the heated oxygen sensor output voltage (O2S) is consistently less than 0.4 V.

Rich: During Control the Injection Volume for A/F Sensor, the AFS Voltage is consistently less than 3.1 V, and the O2S is consistently more than 0.55 V.

Lean/Rich: During Control the Injection Volume for A/F Sensor of the Active Test, the output voltage of the heated oxygen sensor alternates correctly.

C ▶PERFORM CONFIRMATION DRIVING PATTERN
B ▶INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)
A
▼

5.	READ VALUE USING TECHSTREAM (COOLANT TEMP)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.

(e) Read the Data List twice, when the engine is both cold and warmed up.

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Standard value:

With cold engine: Same as ambient air temperature.

With warm engine: 80 to 100°C (176 to 212°F).

NG ▶ REPLACE ENGINE COOLANT TEMPERATURE SENSOR
OK
▼

6.	INSPECT MASS AIR FLOW METER SUB-ASSEMBLY

(a) Inspect the mass air flow meter sub-assembly INFO.

NG ▶ REPLACE MASS AIR FLOW METER SUB-ASSEMBLY
OK
▼

7.	CHECK FUEL PRESSURE

(a) Check the fuel pressure INFO.

NG ▶ REPAIR OR REPLACE FUEL SYSTEM
OK
▼

8.	INSPECT FOR EXHAUST GAS LEAK

(a) Inspect for exhaust gas leaks from the exhaust manifold sub-assembly and exhaust pipes.

OK:

No gas leaks.

NG ▶ REPAIR OR REPLACE EXHAUST SYSTEM
OK
▼

9.	CHECK SPARK AND IGNITION

HINT:

- Refer to the ignition system inspection procedure INFO.
- If the spark plugs or ignition system malfunctions, engine misfires may occur. The misfire count can be read using the Techstream. Enter the following menus: Powertrain / Engine and ECT / Data List / Cylinder #1 Misfire Count (to Cylinder #4 Misfire Count).

NG ▶ REPAIR OR REPLACE IGNITION SYSTEM
OK
▼

10.	INSPECT FUEL INJECTOR ASSEMBLY (INJECTION AND VOLUME)

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HINT:

- Refer to the fuel injector inspection procedure INFO.
- If the injectors malfunction, engine misfires may occur. The misfire count can be read using the Techstream. Enter the following menus: Powertrain / Engine and ECT / Data List / Cylinder #1 Misfire Count (to Cylinder #4 Misfire Count).

Result:

Result	Proceed to
NG	A
OK	B

B ▶PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

A ▶**REPLACE FUEL INJECTOR ASSEMBLY**

11.	INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)

*1



(a) Disconnect the air fuel ratio sensor connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
1 (HA1A) - 2 (+B)	20°C (68°F)	1.8 to 3.4 Ω
1 (HA1A) - 4 (A1A-)	Always	10 kΩ or higher

Text in Illustration

*1	Component without harness connected (to Air Fuel Ratio Sensor)

(c) Reconnect the air fuel ratio sensor connector.

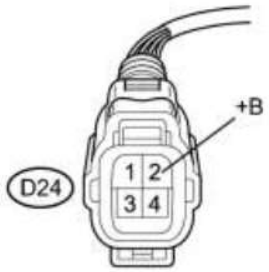
NG ▶REPLACE AIR FUEL RATIO SENSOR

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OK

12.	CHECK TERMINAL VOLTAGE (POWER SOURCE OF AIR FUEL RATIO SENSOR)

*1



(a) Disconnect the air fuel ratio sensor connector.

c

(b) Turn the power switch on (IG).

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
D24-2 (+B) - Body ground	Power switch on (IG)	11 to 14 V

Text in Illustration

*1	Front view of wire harness connector (to Air Fuel Ratio Sensor)

(d) Reconnect the air fuel ratio sensor connector.

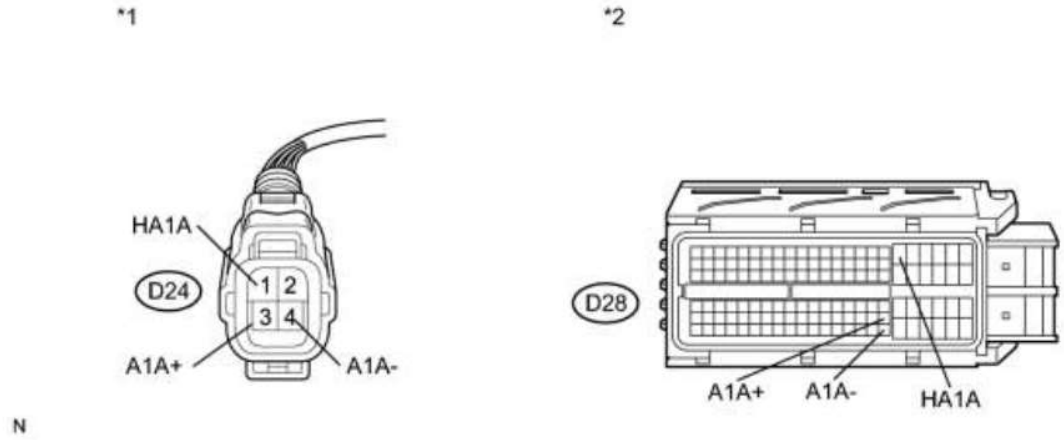
NG REPAIR OR REPLACE HARNESS OR CONNECTOR (AIR FUEL RATIO SENSOR - EFI MAIN RELAY)

OK

13.	CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - ECM)

(a) Disconnect the air fuel ratio sensor connector.

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(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D24-1 (HA1A) - D28-18 (HA1A)	Always	Below 1 Ω
D24-3 (A1A+) - D28-103 (A1A+)	Always	Below 1 Ω
D24-4 (A1A-) - D28-126 (A1A-)	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D24-1 (HA1A) or D28-18 (HA1A) - Body ground	Always	10 kΩ or higher
D24-3 (A1A+) or D28-103 (A1A+) - Body ground	Always	10 kΩ or higher
D24-4 (A1A-) or D28-126 (A1A-) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Air Fuel Ratio Sensor)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the air fuel ratio sensor connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (AIR FUEL RATIO SENSOR - ECM)

OK ▼

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14.	REPLACE AIR FUEL RATIO SENSOR

(a) Replace the air fuel ratio sensor INFO.

NEXT

15.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Turn the power switch off and wait for 30 seconds.

(f) Turn the power switch on (IG) and turn the Techstream on.

(g) Put the engine in inspection mode INFO.

(h) Start the power and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(k) Input the DTC: P0171, P0172.

(l) Check the DTC judgment result.

Result:

Result	Proceed to
ABNORMAL (DTC P0171 or P0172 is output)	A
NORMAL (DTC is not output)	B

B ▶ END

A

16.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

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(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

Result:

Result	Proceed to
Outside of standard range	A
Within standard range	B

B ▶ REPLACE ECM

A ▼

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17.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

NG ▶ REPLACE EGR VALVE ASSEMBLY

OK ▼

18.	REPLACE ECM

(a) Replace the ECM INFO.

NEXT ▼

19.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTC INFO.

(e) Turn the power switch off and wait for 30 seconds.

(f) Turn the power switch on (IG) and turn the Techstream on.

(g) Put the engine in inspection mode INFO.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(k) Input the DTCs: P0171, P0172.

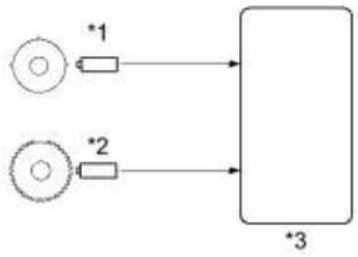
(l) Check the DTCs judgment result.

NEXT ▶ **END**

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DTC	P0300	Random / Multiple Cylinder Misfire Detected
DTC	P0301	Cylinder 1 Misfire Detected
DTC	P0302	Cylinder 2 Misfire Detected
DTC	P0303	Cylinder 3 Misfire Detected
DTC	P0304	Cylinder 4 Misfire Detected

DESCRIPTION



Text in Illustration

*1	Camshaft Position Sensor
*2	Crankshaft Position Sensor
*3	ECM

When the engine misfires, high concentrations of hydrocarbons (HC) enter the exhaust gas. High HC concentration levels can cause an increase in exhaust emission levels. Extremely high concentrations of HC can also cause increases in the three-way catalytic converter temperature, which may cause damage to the three-way catalytic converter. To prevent this increase in emissions and to limit the possibility of thermal damage, the ECM monitors the misfire rate. When the temperature of the three-way catalytic converter reaches the point of thermal degradation, the ECM blinks the MIL. To monitor misfires, the ECM uses both the Camshaft Position (CMP) sensor and the Crankshaft Position (CKP) sensor. The camshaft position sensor is used to identify any misfiring cylinders and the crankshaft position sensor is used to measure variations in the crankshaft rotation speed. Misfires are counted when the crankshaft rotation speed variations exceed predetermined thresholds. If the misfire count exceeds the threshold levels, and could cause emission control system performance deterioration, the ECM illuminates the MIL and sets a DTC.

DTC No.	DTC Detection Condition	Trouble Area
P0300	When one of following conditions below is detected (2 trip detection logic):	• Open or short in engine wire harness • Connector connection

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DTC No.	DTC Detection Condition	Trouble Area
	• High temperature misfire occurs in three-way catalytic converter (MIL blinks) • Emission deterioration misfire occurs (MIL illuminates) • Simultaneous misfiring of several cylinders occurs	• Vacuum hose connections • Ignition system • Fuel injector assembly • Fuel pressure • Mass air flow meter sub-assembly • Engine coolant temperature sensor • Compression pressure • Valve timing • PCV valve and hose • PCV hose connections • Intake system • EGR valve assembly • ECM
P0301 P0302 P0303 P0304	When one of following conditions below is detected (2 trip detection logic): • High temperature misfire occurs in three-way catalytic converter (MIL blinks) • Emission deterioration misfire occurs (MIL illuminates) • Misfiring of specific cylinder occurs	

When DTCs for misfiring cylinders are randomly set, but DTC P0300 is not set, it indicates that misfires have been detected in different cylinders at different times. DTC P0300 is only set when several misfiring cylinders are detected at the same time.

MONITOR DESCRIPTION

The ECM illuminates the MIL and sets a DTC when either one of the following conditions, which could cause emission control system performance deterioration, is detected (2 trip detection logic).

- Within the first 1000 crankshaft revolutions of the engine starting, an excessive misfiring rate (approximately 20 to 50 misfires per 1000 crankshaft revolutions) occurs once.
- An excessive misfiring rate (approximately 20 to 50 misfires per 1000 crankshaft revolutions) occurs a total of 4 times.

The ECM flashes the MIL and sets a DTC when either one of the following conditions, which could cause the three-way catalytic converter damage, is detected (2 trip detection logic).

HINT:

If a catalyst damage misfire occurs, the monitor informs the driver by blinking the MIL (1 trip).

- In every 200 crankshaft revolutions at a high engine speed, the threshold misfiring percentage is recorded once.
- In every 200 crankshaft revolutions at a normal engine speed, the threshold misfiring percentage is recorded 3 times.

Misfire Monitor for Mexico Models

The ECM illuminates the MIL and sets a DTC when either one of the following conditions, which could cause emission deterioration, is detected (2 trip detection logic).

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- Within the first 1000 crankshaft revolutions of the engine starting, an excessive misfiring rate (approximately 1000 misfires per 1000 crankshaft revolutions) occurs once.
- An excessive misfiring rate (approximately 500 misfires per 1000 crankshaft revolutions) occurs a total of 4 times.

The ECM flashes the MIL and sets a DTC when the following condition, which could cause the three-way catalytic converter damage, is detected (2 trip detection logic).

- A catalyst damage misfire, which is monitored every 200 crankshaft revolutions, occurs 3 times.

MONITOR STRATEGY

Related DTCs	P0300: Multiple cylinder misfire P0301: Cylinder 1 misfire P0302: Cylinder 2 misfire P0303: Cylinder 3 misfire P0304: Cylinder 4 misfire
Required Sensors/Components (Main)	Crankshaft position sensor Camshaft position sensor
Required Sensors/Components (Related)	Engine coolant temperature sensor Intake air temperature sensor Mass air flow meter sub-assembly
Frequency of Operation	Continuous
Duration	1000 to 4000 crankshaft revolutions: Emission related misfire 200 to 600 crankshaft revolutions: Catalyst damaging misfire
MIL Operation	2 driving cycles: Emission related misfire MIL flashes immediately: Catalyst damaging misfire
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Misfire

Monitor runs whenever following DTCs are not present	P0016 (VVT System Bank 1 - Misalignment) P0102, P0103 (Mass Air Flow Meter)

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	P0107, P0108 (Manifold Absolute Pressure) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0327, P0328 (Knock Sensor) P0335 (Crankshaft Position Sensor) P0351, P0352, P0353, P0354 (Igniter)
Battery voltage	8 V or more
VVT system	Not operated by scan tool
Engine speed	850 to 5500 rpm
Either of the following conditions (a) or (b) is met	-
(a) Engine coolant temperature at engine start	More than -7°C (19°F)
(b) Engine coolant temperature	More than 20°C (68°F)
Fuel cut	OFF

Monitor Period of Emission-Related Misfire

First 1000 revolutions after engine start, or check mode	Crankshaft 1000 revolutions
Except above	Crankshaft 1000 revolutions x 4

Monitor Period of Catalyst Damaging Misfire (MIL Blinks)

All of the following conditions 1, 2 and 3 are met	Crankshaft 200 revolutions x 3
1. Driving cycles	1st
2. Check mode	OFF
3. Engine speed	Less than 3000 rpm
Except above	Crankshaft 200 revolutions

FOR MEXICO MODELS:

Misfire: for Mexico models

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The monitor will run whenever these DTCs are not present	P0016 (VVT System Bank 1 - Misalignment) P0102, P0103 (Mass Air Flow Meter) P0107, P0108 (Manifold Absolute Pressure) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0327, P0328 (Knock Sensor) P0335 (Crankshaft Position Sensor) P0351, P0352, P0353, P0354 (Igniter)
Battery voltage	8 V or more
VVT system	Not operated by scan tool
Engine speed	850 to 5500 rpm
Engine coolant temperature sensor	More than 70°C (158°F)
Fuel cut	OFF

Monitor period of emission-related-misfire: for Mexico models

First 1000 revolutions after engine start, or check mode	Crankshaft 1000 revolutions
Except above	Crankshaft 1000 revolutions x 4

Monitor period of catalyst-damaged-misfire (MIL blinks): for Mexico models

All of following conditions 1, 2 and 3 met	Crankshaft 200 revolutions
1. Driving cycles	1st
2. Check mode	OFF
Except above	Crankshaft 200 revolutions x 3

TYPICAL MALFUNCTION THRESHOLDS

Monitor Period of Emission Related Misfire

Misfire rate	2% or more

Monitor Period of Catalyst Damaging Misfire (MIL Blinks)

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Number of misfire per 200 revolutions	130 or more (varies with intake air amount per rpm)

FOR MEXICO MODELS:

Monitor period of emission-related-misfire: for Mexico models

Misfire rate	50.0% or more: for 1st 2000 revolutions 25.0% or more: after 1st 2000 revolutions

Monitor period of catalyst-damaged-misfire (MIL blinks): for Mexico models

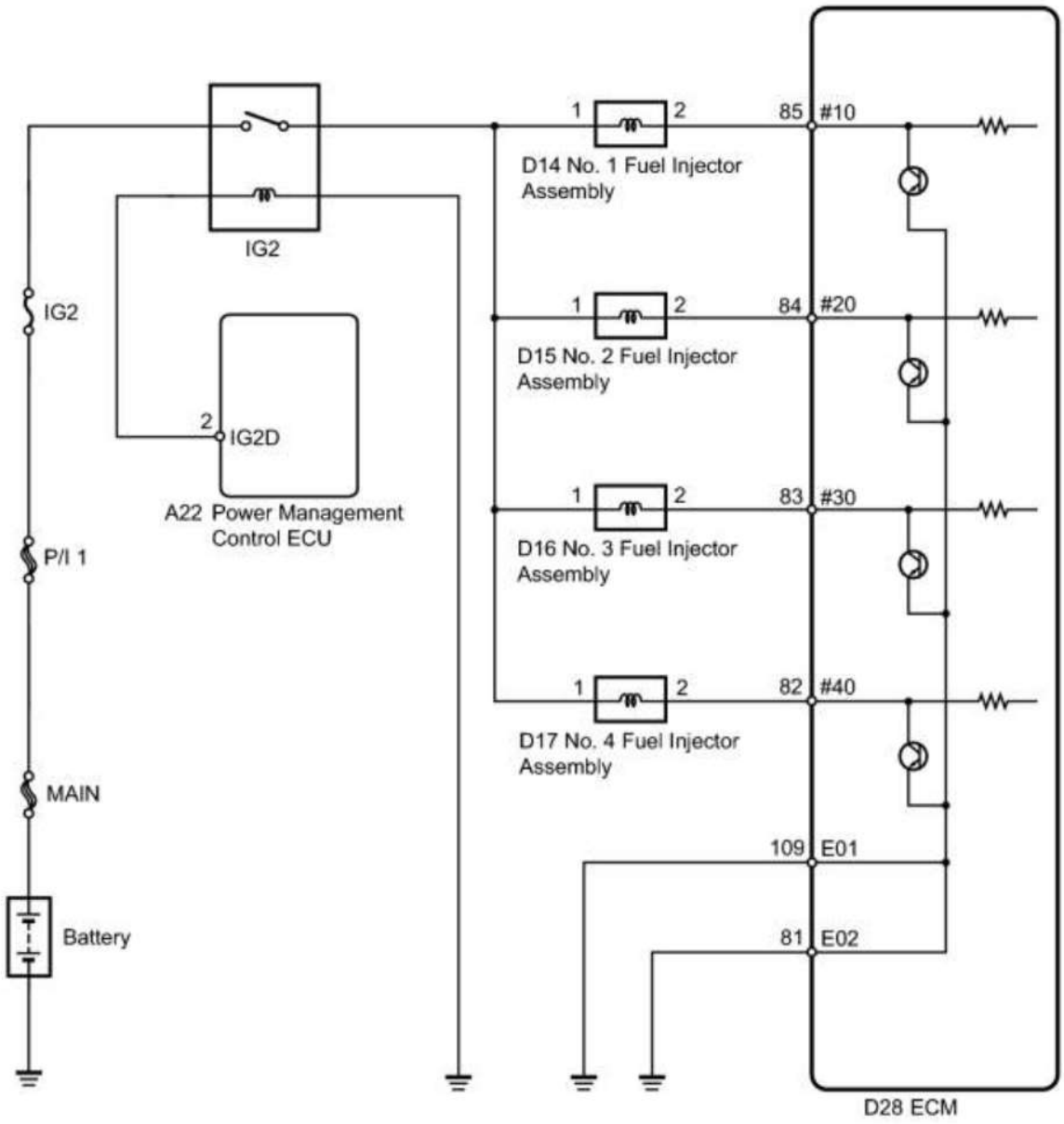
Number of misfire per 200 revolutions	130 or more (varies with intake air amount and rpm)
Paired cylinder misfire (MIL blinks immediately)	Detected

MONITOR RESULT

Refer to Checking Monitor Status INFO.

WIRING DIAGRAM

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CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG).
3. Turn the Techstream on.
4. Record the DTC(s) and freeze frame data.
5. Put the engine in inspection mode INFO.
6. Using the Techstream, switch the ECM from normal mode to check mode INFO.
7. Read the misfire counts of each cylinder, Cylinder #1 Misfire Count to Cylinder #4 Misfire Count, with the engine idling. If any misfire count is displayed, skip the following confirmation driving pattern.
8. Drive the vehicle several times with the conditions, such as engine speed and engine load, shown in Misfire RPM and Misfire Load in the Data List.

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HINT:

In order to store misfire DTCs, it is necessary to operate the vehicle for the period of time shown in the table below, using the Misfire RPM and Misfire Load in the Data List.

Engine Speed	Duration
Idling	4 minutes or more
1000	4 minutes and 30 seconds or more
2000	2 minutes and 30 seconds or more
3000	1 minute and 30 seconds or more

9. Check whether misfires have occurred by checking DTCs and freeze frame data.

   HINT:

   Do not turn the power switch off until the stored DTC(s) and freeze frame data have been recorded. When the ECM returns to normal mode (default), the stored DTC(s), freeze frame data and other data will be cleared.

10. Record the DTC(s), freeze frame data and misfire counts.
11. Turn the power switch off and wait for at least 5 seconds.

INSPECTION PROCEDURE

HINT:

- If any DTCs other than misfire DTCs are output, troubleshoot those DTCs first.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.
- If the misfire does not recur when the vehicle is brought to the workshop, reproduce the conditions stored in the ECM as freeze frame data.
- If the misfire still cannot be reproduced even though the conditions stored in the ECM as freeze frame data have been reproduced, one of the following factors is considered to be a possible cause of the problem:
  a. There was insufficient fuel in the tank.
  b. Improper fuel is used.
  c. The spark plugs have been contaminated.
  d. The problem requires further diagnosis.
- After finishing repairs, check the misfire counts of the cylinders Cylinder #1 Misfire Count to Cylinder #4 Misfire Count.
- Be sure to confirm that no misfiring cylinder DTCs are set again by conducting the confirmation driving pattern after finishing repairs.
- When one of Short FT #1or Long FT #1 in the freeze frame data is outside the range of +/-20%, the air fuel ratio may be Rich (-20% or less) or Lean (+20% or more).
- When the Coolant Temp in the freeze frame data is less than 75°C (167°F), the misfire has occurred only while warming up the engine.

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- An extremely imbalanced drive wheel which causes body vibration may cause misfire DTCs detection.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO MISFIRE DTCS)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

HINT:

Write down the indicated DTCs.

Result:

Result	Proceed to
DTC P0300, P0301, P0302, P0303 and/or P0304 are output	A
DTC P0300, P0301, P0302, P0303 and/or P0304 and other DTCs are output	B

HINT:

If any DTCs other than P0300, P0301, P0302, P0303 and/or P0304 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK PCV HOSE (HOSE CONNECTIONS)

(a) Check the PCV hose connections.

OK:

PCV hose is correctly connected and is not damaged.

NG ▶ REPAIR OR REPLACE PCV HOSE

OK ▼

3.	READ VALUE USING TECHSTREAM (MISFIRE RPM AND MISFIRE LOAD)

(a) Connect the Techstream to the DLC3.

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(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Misfire RPM and Misfire Load.

(e) Read and note the Misfire RPM and Misfire Load values.

HINT:

The Misfire RPM and Misfire Load values indicate the vehicle conditions under which the misfire occurred.

NEXT

4.	READ VALUE USING TECHSTREAM (CYLINDER #1 MISFIRE COUNT, #2, #3 AND #4)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / Cylinder #1 (to #4) Misfire Count.

(f) Read each value for Cylinder #1 (to #4) Misfire Count displayed on the Techstream. If no misfire counts occur in any cylinders, perform steps [A] and [B], and then check the misfire counts again.

(g) Drive the vehicle with the Misfire RPM and Misfire Load noted in the read value using the Techstream (Misfire RPM and Misfire Load) procedures above [A].

(h) Read Cylinder #1 (to #4) Misfire Count or the DTCs displayed on the Techstream [B].

Result:

Misfire Count	Proceed to
Most misfires occur in only 1 or 2 cylinders	A
3 cylinders or more have equal misfire counts	B

HINT:

- If it is difficult to reproduce misfires for each cylinder, check the Data List item called Misfire Margin. Try to find vehicle driving conditions that lower the Misfire Margin value. Values above 30% are considered normal.
- If the freeze frame data record of the engine coolant temperature is below 75°C (167°F), it may only be possible to detect the misfire when the engine is cold.
- If the freeze frame data record of the Engine Run Time is below 120 seconds, the misfire may be detected immediately after the engine is started.

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B ▶ CHECK INTAKE SYSTEM

A ▼

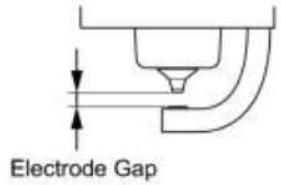
5.	INSPECT SPARK PLUG

(a) Remove the ignition coil assembly and the spark plug of the misfiring cylinder.

(b) Check the electrode for carbon deposits.

Recommended Spark Plug

Manufacturer	Product
DENSO	SC20HR11



P

(c) Measure the spark plug electrode gap.

Maximum Electrode Gap for Used Spark Plug:

1.3 mm (0.0512 in.)

If the gap is greater than the maximum, replace the spark plug.

Electrode Gap for New Spark Plug:

1.0 to 1.1 mm (0.0394 to 0.0433 in.)

(d) Reinstall the ignition coil assembly and spark plug.

NG ▶ REPLACE SPARK PLUG

OK ▼

6.	CHECK FOR SPARK (SPARK TEST)

(a) Perform spark test INFO.

CAUTION:

Always disconnect all fuel injector assembly connectors.

NOTICE:

Do not crank the engine for more than 2 seconds.

OK:

Spark jumps across electrode gap.

NG ▶ CHANGE TO KNOWN GOOD SPARK PLUG AND CHECK SPARK OF MISFIRING CYLINDER

OK

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7.	CHECK CYLINDER COMPRESSION PRESSURE OF MISFIRING CYLINDER

(a) Measure the cylinder compression pressure of the misfiring cylinder INFO.

NG ▶ CHECK ENGINE TO DETERMINE CAUSE OF LOW COMPRESSION

OK

8.	CHECK FUEL INJECTOR ASSEMBLY (POWER SOURCE)

*1



(a) Disconnect the fuel injector assembly connectors.

N

(b) Turn the power switch on (IG).

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
D14-1 - Body ground	Power switch on (IG)	11 to 14 V
D15-1 - Body ground	Power switch on (IG)	11 to 14 V
D16-1 - Body ground	Power switch on (IG)	11 to 14 V
D17-1 - Body ground	Power switch on (IG)	11 to 14 V

Text in Illustration

*1	Front view of wire harness connector (to Fuel Injector Assembly)

(d) Reconnect the fuel injector assembly connectors.

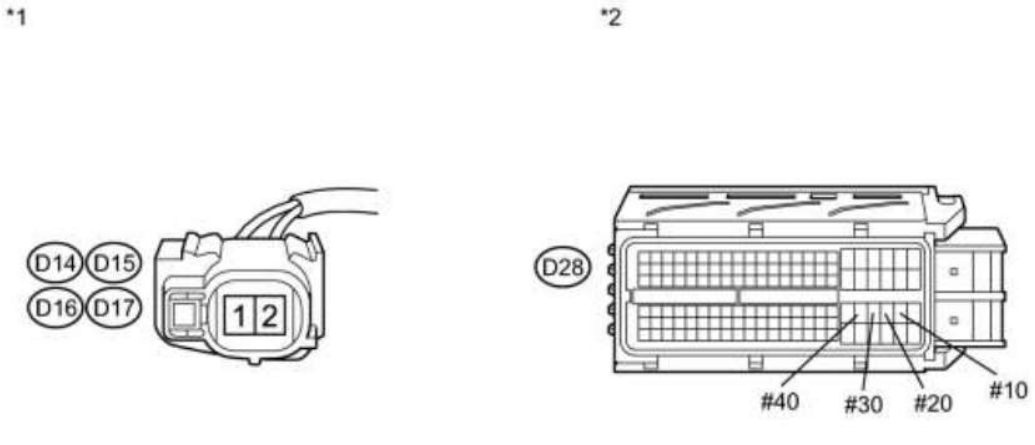
NG ▶ CHECK FUEL INJECTOR CIRCUIT

OK

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9.	CHECK HARNESS AND CONNECTOR (FUEL INJECTOR ASSEMBLY - ECM)

(a) Disconnect the fuel injector assembly connectors.



(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D14-2 - D28-85 (#10)	Always	Below 1 Ω
D15-2 - D28-84 (#20)	Always	Below 1 Ω
D16-2 - D28-83 (#30)	Always	Below 1 Ω
D17-2 - D28-82 (#40)	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D14-2 or D28-85 (#10) - Body ground	Always	10 Ω or higher
D15-2 or D28-84 (#20) - Body ground	Always	10 Ω or higher
D16-2 or D28-83 (#30) - Body ground	Always	10 Ω or higher
D17-2 or D28-82 (#40) - Body ground	Always	10 Ω or higher

Text in Illustration

*1	Front view of wire harness connector (to Fuel Injector Assembly)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the fuel injector assembly connectors.

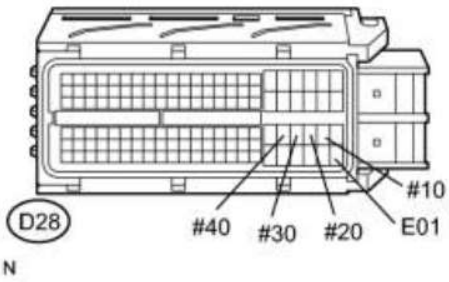
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(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (FUEL INJECTOR ASSEMBLY - ECM)
OK
▼

10.	INSPECT ECM TERMINAL OF MISFIRING CYLINDER (#10, #20, #30 AND/OR #40 VOLTAGE)

*1



N

(a) Disconnect the ECM connector.

(b) Turn the power switch on (IG).

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
D28-85 (#10) - D28-109 (E01)	Power switch on (IG)	11 to 14 V
D28-84 (#20) - D28-109 (E01)	Power switch on (IG)	11 to 14 V
D28-83 (#30) - D28-109 (E01)	Power switch on (IG)	11 to 14 V
D28-82 (#40) - D28-109 (E01)	Power switch on (IG)	11 to 14 V

Text in Illustration

*1	Front view of wire harness connector (to ECM)

(d) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - BODY GROUND)
OK
▼

11.	CHECK FUEL INJECTOR ASSEMBLY OF MISFIRING CYLINDER

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(a) Check the fu INFO ector assembly injection (whether fuel volume is high or low, and whether injection pattern is poor) .

NG ▶ REPLACE FUEL INJECTOR ASSEMBLY
OK
▼

12.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO.

OK:

No leaks in intake system.

NG ▶ REPAIR OR REPLACE INTAKE SYSTEM
OK
▼

13.	INSPECT MASS AIR FLOW METER SUB-ASSEMBLY

(a) Inspect the mass air flow meter sub-assembly INFO.

NG ▶ REPLACE MASS AIR FLOW METER SUB-ASSEMBLY
OK
▼

14.	CHECK FUEL PRESSURE

(a) Check the fuel pressure INFO.

NG ▶ CHECK FUEL LINE
OK
▼

15.	READ VALUE USING TECHSTREAM (COOLANT TEMP)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.

(e) Read the Data List twice, when the engine is both cold and warmed up.

Standard value:

With cold engine:

Same as ambient air temperature.

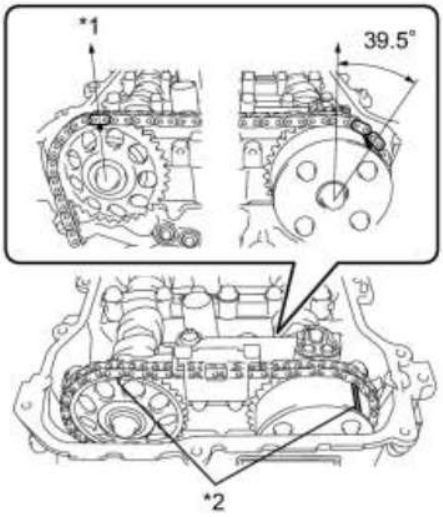
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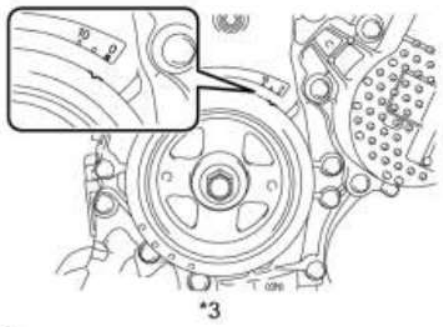
With warm engine:

80 to 100°C (176 to 212°F).

NG ▶ REPLACE ENGINE COOLANT TEMPERATURE SENSOR
OK
▼

16.	ADJUST VALVE TIMING





C

HINT:

There are no marks on the cylinder head to match-up for the purpose of checking valve timing. Valve timing can only be inspected by lining up the colored plates on the timing chain with the marks on the pulleys. It may be necessary to remove and reinstall the chain to match-up the alignment marks INFO.

Text in Illustration

*1	Top
*2	Alignment Mark
*3	No. 1 Cylinder at TDC Compression

NEXT
▼

17.	CHECK WHETHER DTC OUTPUT RECURS (P0300, P0301, P0302, P0303 OR P0304)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Perform confirmation driving pattern.

(e) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(f) Read the pending DTCs.

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Result:

Result	Proceed to
DTC P0300, P0301, P0302, P0303 or P0304 is output	A
DTC is not output	B

B ▶ END

A ▼

18.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP	MAP value is 20 to 40 kPa (150 to	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

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-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
(Data List)	300 mmHg) (EGR valve is fully closed)	

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

Result:

Result	Proceed to
Outside of standard range	A
Within standard range	B

B ▶ REPLACE ECM

A ▼

19.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

NG ▶ REPLACE EGR VALVE ASSEMBLY

OK ▼

20.	REPLACE ECM

(a) Replace the ECM INFO.

NEXT ▼

21.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

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(c) Turn the Techstream on.

(d) Clear the DTC INFO.

(e) Turn the power switch off and wait for 30 seconds.

(f) Turn the power switch on (IG) and turn the Techstream on.

(g) Put the engine in inspection mode INFO.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(k) Input the DTCs: P0300, P0301, P0302, P0303, P0304.

(l) Check the DTCs judgment result.

NEXT ▶ **END**

22.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO.

OK:

No leaks in intake system.

NG ▶ REPAIR OR REPLACE INTAKE SYSTEM

OK ▼

23.	INSPECT MASS AIR FLOW METER SUB-ASSEMBLY

(a) Inspect the mass air flow meter sub-assembly INFO.

NG ▶ REPLACE MASS AIR FLOW METER SUB-ASSEMBLY

OK ▼

24.	CHECK FUEL PRESSURE

(a) Check the fuel pressure INFO.

NG ▶ CHECK FUEL LINE

OK ▼

25.	READ VALUE USING TECHSTREAM (COOLANT TEMP)

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(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.

(e) Read the Data List twice, when the engine is both cold and warmed up.

Standard value:

With cold engine:

Same as ambient air temperature.

With warm engine:

80 to 100°C (176 to 212°F).

NG ▶ REPLACE ENGINE COOLANT TEMPERATURE SENSOR

OK ▼

26.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

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OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

Result:

Result	Proceed to
Outside of standard range	A
Within standard range	B

B ▶ INSPECT SPARK PLUG

A ▼

27.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

NG ▶ REPLACE EGR VALVE ASSEMBLY

OK ▼

28.	INSPECT SPARK PLUG

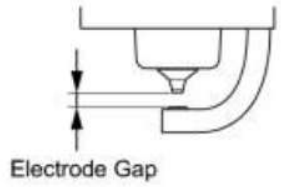
(a) Remove the ignition coil assembly and the spark plug of the misfiring cylinder.

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(b) Check the electrode for carbon deposits.

Recommended Spark Plug

Manufacturer	Product
DENSO	SC20HR11



P

(c) Measure the spark plug electrode gap.

Maximum Electrode Gap for Used Spark Plug:

1.3 mm (0.0512 in.)

If the gap is greater than the maximum, replace the spark plug.

Electrode Gap for New Spark Plug:

1.0 to 1.1 mm (0.0394 to 0.0433 in.)

(d) Reinstall the ignition coil assembly and spark plug.

NG ▶ REPLACE SPARK PLUG
OK
▼

29.	CHECK FOR SPARK (SPARK TEST)

(a) Perform spark test INFO.

CAUTION:

Always disconnect all fuel injector assembly connectors.

NOTICE:

Do not crank the engine for more than 2 seconds.

OK:

Spark jumps across electrode gap.

NG ▶ CHANGE TO KNOWN GOOD SPARK PLUG AND CHECK SPARK OF MISFIRING CYLINDER
OK
▼

30.	CHECK CYLINDER COMPRESSION PRESSURE OF MISFIRING CYLINDER

(a) Measure the cylinder compression pressure of the misfiring cylinder INFO.

NG ▶ CHECK ENGINE TO DETERMINE CAUSE OF LOW COMPRESSION
OK

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31.	CHECK FUEL INJECTOR ASSEMBLY (POWER SOURCE)

*1



(a) Disconnect the fuel injector assembly connectors.

N

(b) Turn the power switch on (IG).

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
D14-1 - Body ground	Power switch on (IG)	11 to 14 V
D15-1 - Body ground	Power switch on (IG)	11 to 14 V
D16-1 - Body ground	Power switch on (IG)	11 to 14 V
D17-1 - Body ground	Power switch on (IG)	11 to 14 V

Text in Illustration

*1	Front view of wire harness connector (to Fuel Injector Assembly)

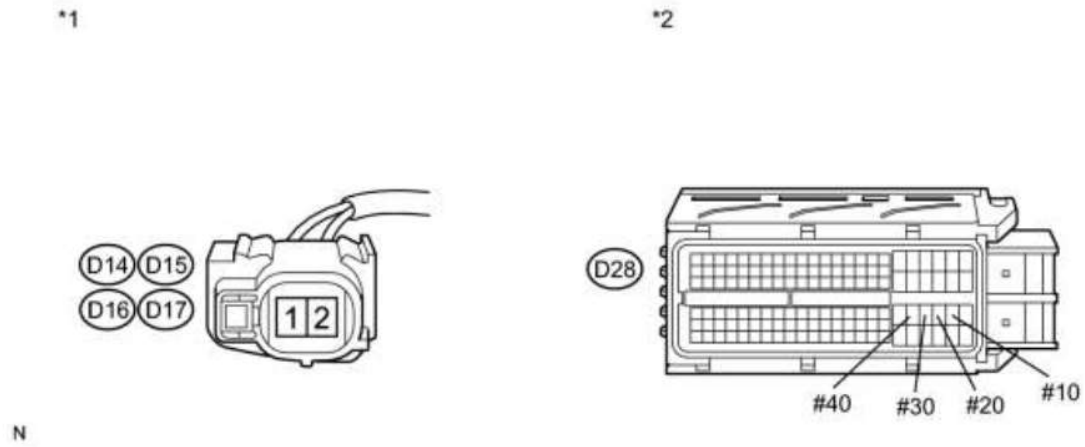
(d) Reconnect the fuel injector assembly connectors.

NG ▶ CHECK FUEL INJECTOR CIRCUIT
OK

32.	CHECK HARNESS AND CONNECTOR (FUEL INJECTOR ASSEMBLY- ECM)

(a) Disconnect the fuel injector assembly connectors.

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(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D14-2 - D28-85 (#10)	Always	Below 1 Ω
D15-2 - D28-84 (#20)	Always	Below 1 Ω
D16-2 - D28-83 (#30)	Always	Below 1 Ω
D17-2 - D28-82 (#40)	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D14-2 or D28-85 (#10) - Body ground	Always	10 Ω or higher
D15-2 or D28-84 (#20) - Body ground	Always	10 Ω or higher
D16-2 or D28-83 (#30) - Body ground	Always	10 Ω or higher
D17-2 or D28-82 (#40) - Body ground	Always	10 Ω or higher

Text in Illustration

*1	Front view of wire harness connector (to Fuel Injector Assembly)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the fuel injector assembly connectors.

(e) Reconnect the ECM connector.

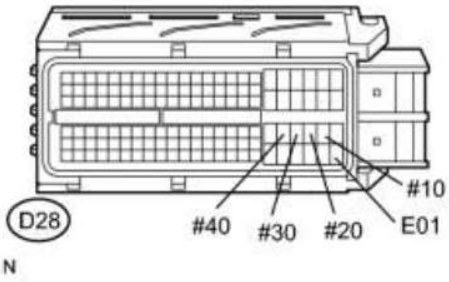
NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (FUEL INJECTOR ASSEMBLY - ECM)

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OK

33.	INSPECT ECM TERMINAL OF MISFIRING CYLINDER (#10, #20, #30 AND/OR #40 VOLTAGE)

*1



(a) Disconnect the ECM connector.

(b) Turn the power switch on (IG).

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
D28-85 (#10) - D28-109 (E01)	Power switch on (IG)	11 to 14 V
D28-84 (#20) - D28-109 (E01)	Power switch on (IG)	11 to 14 V
D28-83 (#30) - D28-109 (E01)	Power switch on (IG)	11 to 14 V
D28-82 (#40) - D28-109 (E01)	Power switch on (IG)	11 to 14 V

Text in Illustration

*1	Front view of wire harness connector (to ECM)

(d) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - BODY GROUND)

OK

34.	CHECK FUEL INJECTOR ASSEMBLY OF MISFIRING CYLINDER

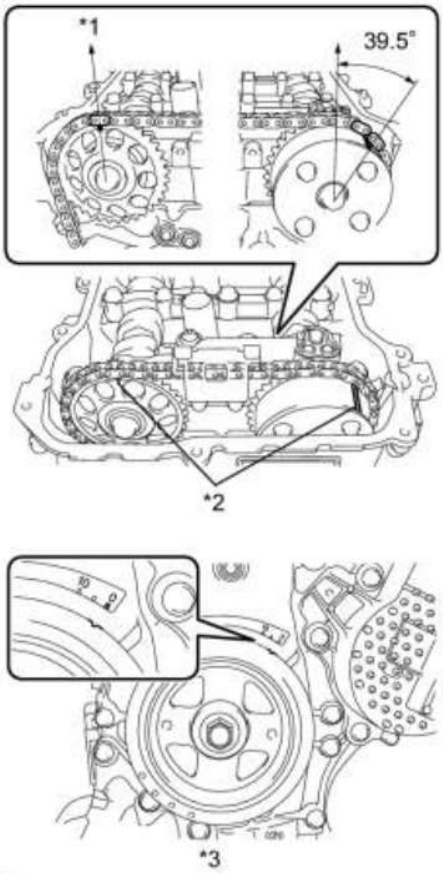
(a) Check the fuel injector assembly injection (whether fuel volume is high or low, and whether injection pattern is poor) INFO.

NG ▶ REPLACE FUEL INJECTOR ASSEMBLY

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OK

35.	ADJUST VALVE TIMING



HINT:

There are no marks on the cylinder head to match-up for the purpose of checking valve timing. Valve timing can only be inspected by lining up the colored plates on the timing chain with the marks on the pulleys. It may be necessary to remove and reinstall the chain to match-up the alignment marks INFO.

Text in Illustration

*1	Top
*2	Alignment Mark
*3	No. 1 Cylinder at TDC Compression

NEXT

36.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0300, P0301, P0302, P0303 OR P0304)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Perform confirmation driving pattern.

(e) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(f) Read the pending DTCs.

Result:

Result	Proceed to
DTC P0300, P0301, P0302, P0303 or P0304 is output	A

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Result	Proceed to
DTC is not output	B

B ▶ END

A ▼

37.	REPLACE ECM

(a) Replace the ECM INFO.

NEXT ▼

38.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTC INFO.

(e) Turn the power switch off and wait for 30 seconds.

(f) Turn the power switch on (IG) and turn the Techstream on.

(g) Put the engine in inspection mode INFO.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(k) Input the DTCs: P0300, P0301, P0302, P0303, P0304.

(l) Check the DTCs judgment result.

NEXT ▶ **END**

39.	CHANGE TO KNOWN GOOD SPARK PLUG AND CHECK SPARK OF MISFIRING CYLINDER

(a) Change the installed spark plug to a known good spark plug.

(b) Perform a spark test INFO.

CAUTION:

Always disconnect all fuel injector assembly connectors.

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NOTICE:

Do not crank the engine for more than 2 seconds.

OK:

Spark jumps across electrode gap.

NG ▶ CHANGE TO KNOWN GOOD IGNITION COIL AND CHECK SPARK OF MISFIRING CYLINDER
OK ▶ **REPLACE SPARK PLUG**

40.	CHANGE TO KNOWN GOOD IGNITION COIL AND CHECK SPARK OF MISFIRING CYLINDER

(a) Change the ignition coil assembly to a known good ignition coil assembly.

(b) Perform a spark test INFO.

CAUTION:

Always disconnect all fuel injector assembly connectors.

NOTICE:

Do not crank the engine for more than 2 seconds.

OK:

Spark jumps across electrode gap.

NG ▶ REPLACE ECM
OK ▶ **REPLACE IGNITION COIL ASSEMBLY**

41.	CHECK FUEL LINE

(a) Check the fuel lines for leaks or blockage.

NG ▶ REPAIR OR REPLACE FUEL LINE
OK ▶ **REPLACE FUEL PUMP**

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DTC	P0327	Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)
DTC	P0328	Knock Sensor 1 Circuit High Input (Bank 1 or Single Sensor)

DESCRIPTION

A flat type knock control sensor is used. Flat type knock control sensors (non-resonant type) have a structure that can detect vibrations over a wide band of frequencies: between approximately 6 kHz and 15 kHz.

Knock control sensors are fitted onto the engine block to detect engine knocking.

The knock control sensor contains a piezoelectric element which generates a voltage when it becomes deformed.

The voltage is generated when the engine block vibrates due to knocking. Occurrence of engine knocking can be suppressed by delaying the ignition timing.

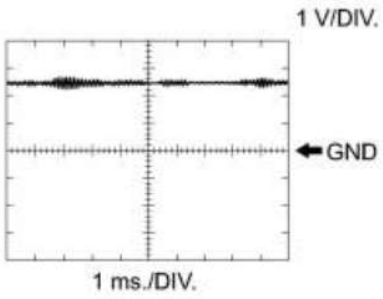
DTC No.	DTC Detection Condition	Trouble Area
P0327	Output voltage of knock control sensor less than 0.5 V for 1 second or more (1 trip detection logic)	• Short in knock control sensor circuit • Knock control sensor • ECM
P0328	Output voltage of knock control sensor more than 4.5 V for 1 second or more (1 trip detection logic)	• Open in knock control sensor circuit • Knock control sensor • ECM

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HINT:

When either DTC P0327 or P0328 is set, the ECM enters fail-safe mode. During fail-safe mode, the ignition timing is delayed to its maximum retardation. Fail-safe mode continues until the power switch is turned off.

Reference: Inspection using an oscilloscope



T

The correct waveform is as shown.

ECM Terminal Name	Between KNK1 and EKNK
Tester Range	1 V/DIV., 1 ms./DIV.
Condition	Engine speed maintained at 4000 rpm after warming up engine

MONITOR DESCRIPTION

If the output voltage transmitted by the knock sensor remains low or high for more than 1 second, the ECM interprets this as a malfunction in the sensor circuit, and sets a DTC.

The monitor for DTCs P0327 and P0328 begins to run when 5 seconds have elapsed since the engine was started.

If the malfunction is not repaired successfully, DTC P0327 or P0328 is set 5 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0327: Knock sensor (bank 1) range check (Low voltage) P0328: Knock sensor (bank 1) range check (High voltage)
Required Sensors/Components (Main)	Knock control sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	1 second
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

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Monitor runs whenever following DTCs are not present	None
Battery voltage	10.5 V or more
Time after engine start	5 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

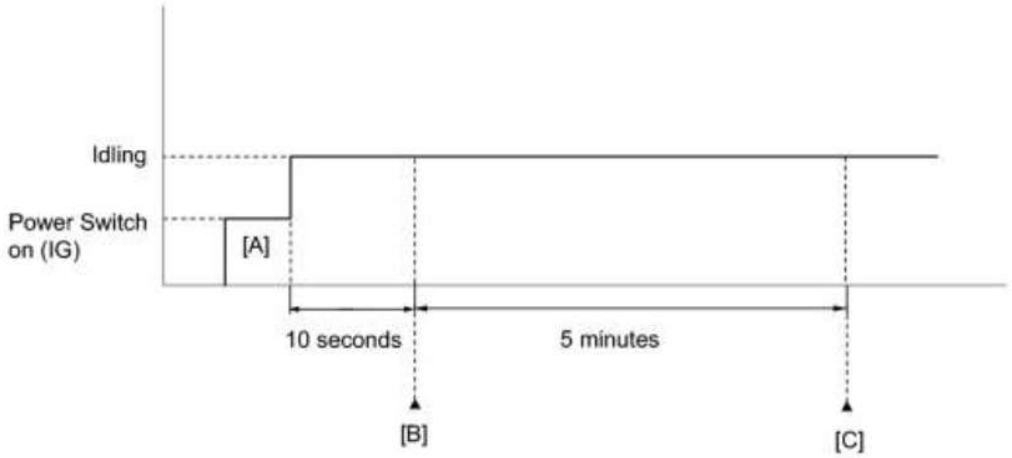
Knock Sensor Range Check (Low Voltage) P0327

Knock sensor voltage	Less than 0.5 V

Knock Sensor Range Check (High Voltage) P0328

Knock sensor voltage	More than 4.5 V

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine and wait 10 seconds.
8. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
9. Read the DTC [B].
10. If a DTC is output, the system is malfunctioning.

HINT:

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If a DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
12. Input the DTC: P0327 or P0328.
13. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, idle the engine for 5 minutes.

14. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Check the judgment result [C].

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

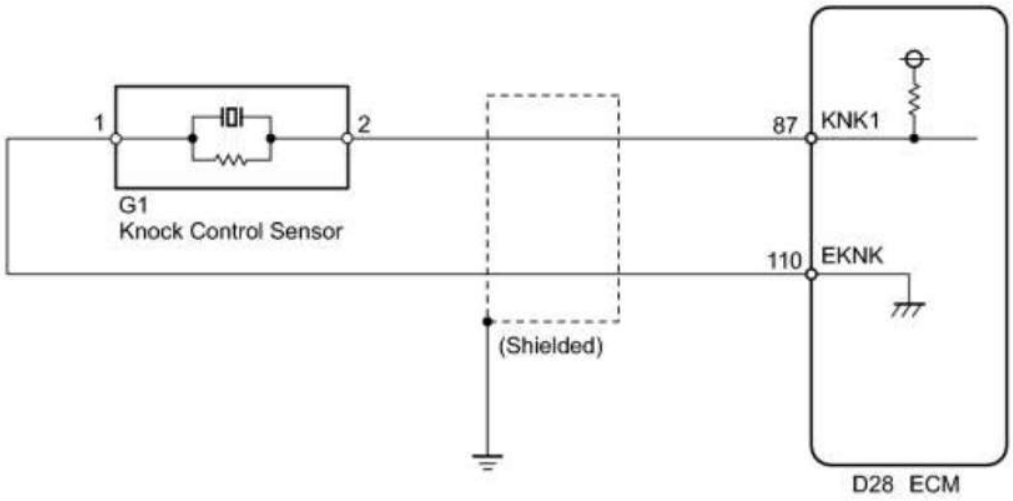
16. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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Y

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	READ VALUE USING TECHSTREAM (KNOCK FEEDBACK VALUE)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG) and turn the Techstream on.

(c) Put the engine in inspection mode INFO.

(d) Start the engine.

(e) Warm up the engine.

(f) Enter the following menus: Powertrain / Engine and ECT / Knock Feedback Value.

(g) Read the value while driving the vehicle.

OK:

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The value changes.

Malfunction does not occur	Knock Feedback Value changes
Malfunctions occur	Knock Feedback Value does not change

HINT:

The knock feedback value change can be confirmed by running the engine with a high load, for example, by activating the air conditioning system and racing the engine.

NG ▶ INSPECT ECM (KNK1 VOLTAGE)
OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

2.	INSPECT ECM (KNK1 VOLTAGE)

*1



(a) Disconnect the knock control sensor connector.

N

(b) Turn the power switch on (IG).

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
G1-2 - G1-1	Power switch on (IG)	4.5 to 5.5 V

Text in Illustration

*1	Front view of wire harness connector (to Knock Control Sensor)

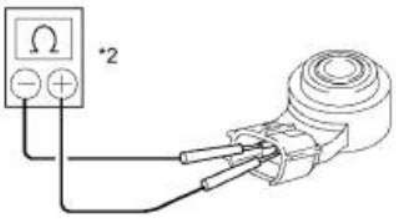
(d) Reconnect the knock control sensor connector.

NG ▶ CHECK HARNESS AND CONNECTOR (ECM - KNOCK CONTROL SENSOR)
OK
▼

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3.	INSPECT KNOCK CONTROL SENSOR

*1



(a) Remove the knock control sensor.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	120 to 280 kΩ

Text in Illustration

*1	Component without harness connected (Knock Control Sensor)
*2	Ohmmeter

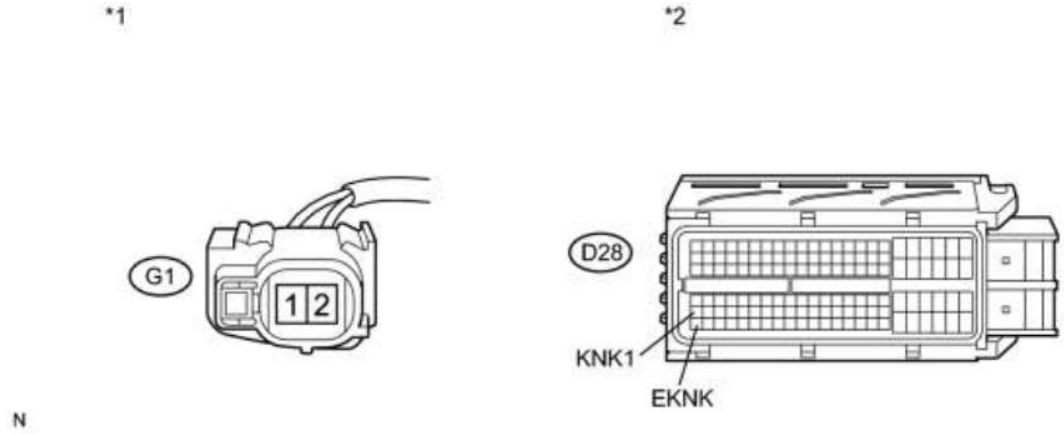
(c) Reinstall the knock control sensor.

NG ▶ REPLACE KNOCK CONTROL SENSOR
OK ▶ **REPLACE ECM**

4.	CHECK HARNESS AND CONNECTOR (ECM - KNOCK CONTROL SENSOR)

(a) Disconnect the knock control sensor connector.

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(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
G1-2 - D28-87 (KNK1)	Always	Below 1 Ω
G1-1 - D28-110 (EKNK)	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
G1-2 or D28-87 (KNK1) - Body ground	Always	10 kΩ or higher
G1-1 or D28-110 (EKNK) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Knock Control Sensor)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the knock control sensor connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - KNOCK CONTROL SENSOR)
OK ▶ **REPLACE ECM**

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DTC	P0335	Crankshaft Position Sensor "A" Circuit

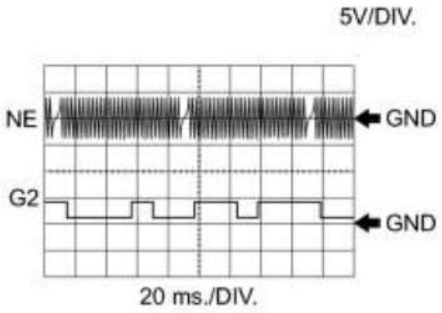
DESCRIPTION

The crankshaft position sensor system consists of a crankshaft position sensor plate and a pickup coil.

The sensor plate has 34 teeth and is installed on the crankshaft. The pickup coil is made of wound copper wire, an iron core and magnet. The sensor plate rotates and, as each tooth passes by the pickup coil, a pulse signal is created. The pickup coil generates 34 signals per engine revolution. Based on these signals, the ECM calculates the crankshaft position and engine speed. Using these calculations, the fuel injection time and ignition timing are controlled.

DTC No.	DTC Detection Condition	Trouble Area
P0335	When either of following conditions are met: (1 trip detection logic) • Missing crankshaft position sensor signal despite camshaft position sensor signal inputs normal after engine cranked • No crankshaft position sensor signal to ECM	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • No. 1 crankshaft position sensor plate • ECM

- Reference: Inspection using an oscilloscope.



HINT:

- The correct waveform is as shown.
- G2+ is camshaft position sensor signals, and NE+ is the crankshaft position sensor signal.
- A failure of the ground for the shielding of the wiring may result in noisy waveforms.

ECM Terminal Name	Between NE+ and NE- Between G2+ and G2-
Tester Range	5 V/DIV., 20 ms./DIV.

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Condition	Idling with warm engine

MONITOR DESCRIPTION

If there is no signal from the crankshaft position sensor despite the engine rotating, the ECM interprets this as a malfunction of the sensor.

If the malfunction is not repaired successfully, a DTC is set 10 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0335: Crankshaft position sensor verify pulse input P0335: Crankshaft position sensor range check or rationality
Required Sensors/Components (Main)	Crankshaft position sensor
Required Sensors/Components (Related)	Camshaft position sensor
Frequency of Operation	Continuous
Duration	1.85 seconds: Verify pulses input (case 1) 15 seconds: Verify pulses input (case 2) 0.016 seconds: Range check or rationality
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not present	None

P0335: Crankshaft Position Sensor Verify Pulse Input (Case 1)

Time after power switch off to on (IG)	More than 0.5 seconds
Lost communication with power management control ECU	Not detected

P0335: Crankshaft Position Sensor Verify Pulse Input (Case 2)

Time after power switch off to on (IG)	More than 0.5 seconds
Engine speed	600 rpm or less
Time after starter ON to OFF	3 seconds or more
Lost communication with power management control ECU	Not detected

P0335: Crankshaft Position Sensor Range Check or Rationality

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NE signal	Input
Time after starter OFF to ON	2.5 seconds or more
Camshaft position sensor circuit fail (P0340, P0342, P0343)	Not detected
Number of camshaft position sensor signal pulse	6 times or more
Battery voltage	7 V or more
Lost communication with power management control ECU	Not detected

TYPICAL MALFUNCTION THRESHOLDS

P0335: Crankshaft Position Sensor Verify Pulse Input (Case 1)

Engine speed signal	No signal

P0335: Crankshaft Position Sensor Verify Pulse Input (Case 2)

Engine speed signal	No signal

P0335: Crankshaft Position Sensor Range Check or Rationality

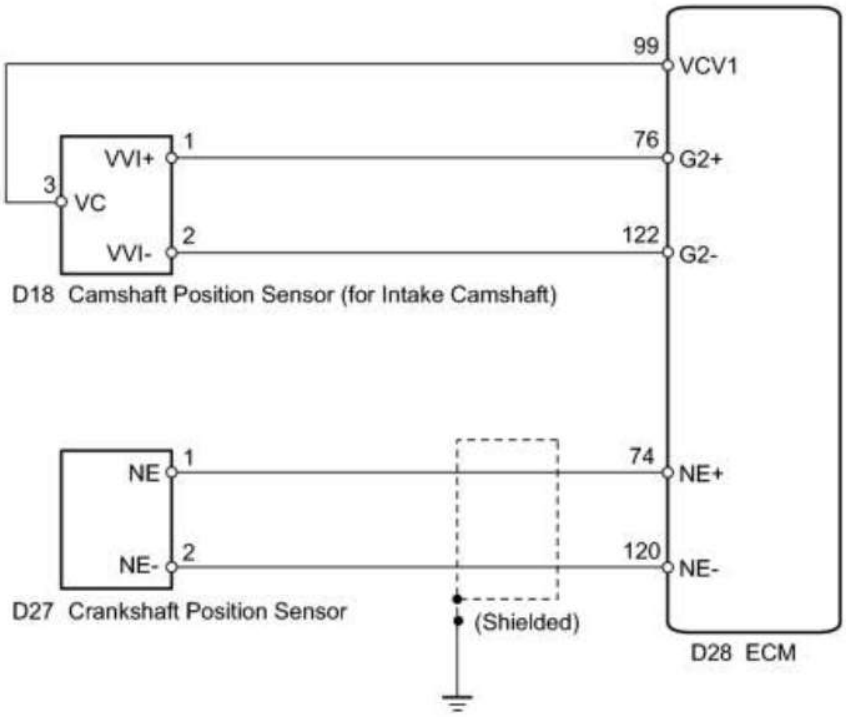
Number of crankshaft position sensor signal pulse	87 times or less, or 219 times or more

COMPONENT OPERATING RANGE

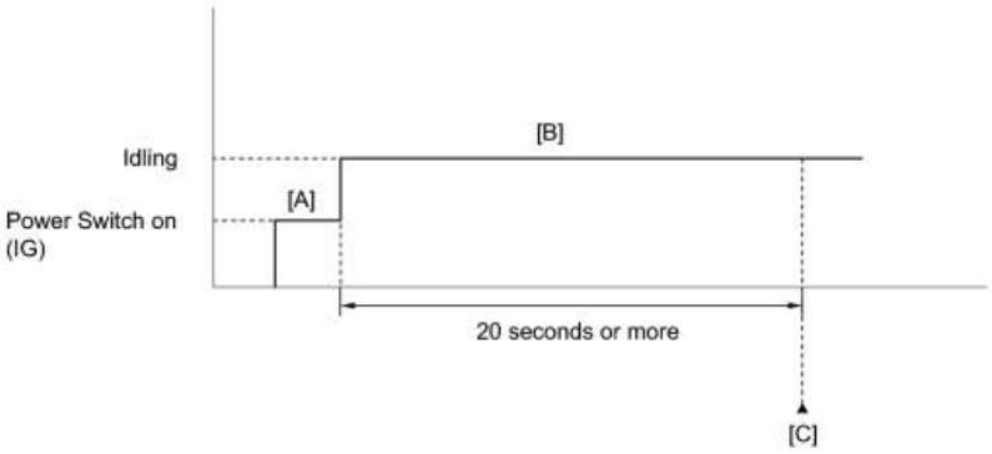
Crankshaft position sensor	• Crankshaft position sensor output voltage fluctuates while crankshaft revolving • 34 crankshaft position sensor signals per crankshaft revolution

WIRING DIAGRAM

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CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.

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5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine.
8. Idle the engine for 20 seconds or more [B].
9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
10. Read the DTC [C].
11. If a DTC is output, the system is malfunctioning.

HINT:

If a DTC is not output, perform the following procedure.

12. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
13. Input the DTC: P0335.
14. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

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HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform step [B] again.

15. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
16. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

17. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

- If no problem is found through this diagnostic troubleshooting procedure, troubleshoot the engine mechanical systems.
- Check the engine speed. The engine speed can be checked using the Techstream. To check, follow the operation below:
  a. Connect the Techstream to the DLC3.
  b. Turn the power switch on (IG) and turn the Techstream on.
  c. Put the engine in inspection mode INFO.
  d. Start the engine.
  e. Enter the following menus: Powertrain / Engine and ECT / Data List / Engine Speed.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	READ VALUE USING TECHSTREAM (ENGINE SPEED)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Enter the following menus: Powertrain / Engine and ECT / Data List / Engine Speed.

(f) Start the engine.

(g) Read the values displayed on the Techstream while the engine is running.

OK:

Correct values are displayed.

HINT:

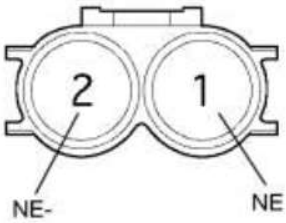
- To check the engine speed change, display the graph on the Techstream.
- If the engine does not start, check the engine speed while cranking.
- If the engine speed indicated on the Techstream remains at zero (0), there may be an open or short in the crankshaft position sensor circuit.

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NG ▶ INSPECT CRANKSHAFT POSITION SENSOR (RESISTANCE)
OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

2.	INSPECT CRANKSHAFT POSITION SENSOR (RESISTANCE)

*1



(a) Disconnect the crankshaft position sensor connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
1 (NE) - 2 (NE-)	Cold	1630 to 2740 Ω
1 (NE) - 2 (NE-)	Hot	2065 to 3225 Ω

HINT:

"Cold" and "Hot" mean the temperature of the coils themselves. "Cold" is from -10 to 50°C (14 to 122°F) and "Hot" is from 50 to 100°C (122 to 212°F).

If the resistance is not as specified, replace the sensor.

Text in Illustration

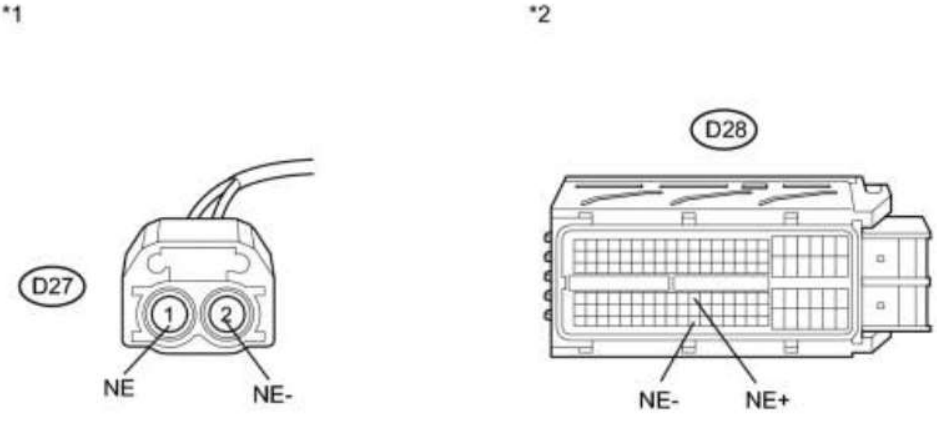
*1	Component without harness connected (Crankshaft Position Sensor)

(c) Reconnect the crankshaft position sensor connector.

NG ▶ REPLACE CRANKSHAFT POSITION SENSOR
OK
▼

3.	CHECK HARNESS AND CONNECTOR (CRANKSHAFT POSITION SENSOR - ECM)

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(a) Disconnect the crankshaft position sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D27-1 (NE) - D28-74 (NE+)	Always	Below 1 Ω
D27-2 (NE-) - D28-120 (NE-)	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D27-1 (NE) or D28-74 (NE+) - Body ground	Always	10 kΩ or higher
D27-2 (NE-) or D28-120 (NE-) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Crankshaft Position Sensor)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the crankshaft position sensor connector.

(e) Reconnect the ECM connector.

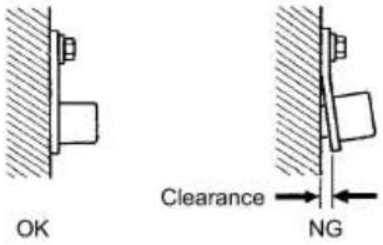
NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (CRANKSHAFT POSITION SENSOR - ECM)

OK ▼

4.	CHECK SENSOR INSTALLATION (CRANKSHAFT POSITION SENSOR)

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(a) Check the crankshaft position sensor installation.



OK:

Sensor is installed correctly.

NG ▶ SECURELY REINSTALL SENSOR

OK ▼

5.	INSPECT NO. 1 CRANKSHAFT POSITION SENSOR PLATE (TEETH OF SENSOR PLATE)

(a) Check the teeth of the No. 1 crankshaft position sensor plate INFO.

OK:

Sensor plate does not have any cracks or deformation.

NG ▶ REPLACE NO. 1 CRANKSHAFT POSITION SENSOR PLATE

OK ▼

6.	REPLACE CRANKSHAFT POSITION SENSOR

(a) Replace the crankshaft position sensor INFO.

NEXT ▼

7.	CHECK WHETHER DTC OUTPUT RECURS

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Put the engine in inspection mode INFO.

(f) Start the engine.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Read the DTCs.

Result:

Result	Proceed to

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Result	Proceed to
DTC is not output	A
DTC P0335 is output	B

HINT:

If the engine does not start, replace the ECM.

B ▶ REPLACE ECM
A ▶ **END**

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DTC	P0340	Camshaft Position Sensor Circuit Malfunction
DTC	P0342	Camshaft Position Sensor "A" Circuit Low Input (Bank 1 or Single Sensor)
DTC	P0343	Camshaft Position Sensor "A" Circuit High Input (Bank 1 or Single Sensor)

DESCRIPTION

The camshaft position sensor for intake camshaft (G2 signal sensor) consists of a magnet and MR element.

The camshaft has a timing rotor for the camshaft position sensor. When the camshaft rotates, changes occur in the air gaps between the timing rotor and MR element, which affects the magnet. As a result, the resistance of the MRE material fluctuates. The camshaft position sensor converts the camshaft rotation data to pulse signals, and uses the pulse signals to determine the camshaft angle, which it sends to the ECM. Then the ECM uses this data to control fuel injection time and injection timing.

DTC No.	DTC Detection Condition	Trouble Area
P0340	When ether of following conditions is met: • No camshaft position sensor signal to ECM at engine speed 600 rpm or more (1 trip detection logic) • Missing camshaft position sensor signal despite crankshaft position sensor inputs normal at engine speed of 600 rpm or more (1 trip detection logic)	• Open or short in camshaft position sensor circuit • Camshaft position sensor • Intake camshaft • Jumped tooth of timing chain for intake camshaft • ECM
P0342	Output voltage of camshaft position sensor less than 0.3 V for 4 seconds (1 trip detection logic)	• Open or short in camshaft position sensor circuit • Camshaft position sensor • Intake camshaft • Jumped tooth of timing chain for intake camshaft • ECM
P0343	Output voltage of 4.7 V for 4 seconds (1 trip detection logic)	• Open or short in camshaft position sensor circuit • Camshaft position sensor • Intake camshaft • Jumped tooth of timing chain for intake camshaft • ECM

HINT:

DTC P0340 indicates a malfunction relating to the camshaft position sensor circuit (the wire harness between the ECM and camshaft position sensor, and the camshaft position sensor itself).

Reference: Inspection using an oscilloscope INFO.

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MONITOR DESCRIPTION

If no signal is transmitted by the camshaft position sensor despite the engine revolving, or the rotation of the camshaft and the crankshaft is not synchronized, the ECM interprets this as a malfunction of the sensor.

If the malfunction is not repaired successfully, the DTC is set 10 seconds after the engine is nest started.

MONITOR STRATEGY

Related DTCs	P0340: Camshaft position sensor verify pulse input P0342: Camshaft position sensor range check (Low voltage) P0343: Camshaft position sensor range check (High voltage)
Required Sensors/Components (Main)	Camshaft position sensor
Required Sensors/Components (Related)	Crankshaft position sensor
Frequency of Operation	Continuous
Duration	5 seconds: Camshaft position /sensor verify pulse input 4 seconds: Camshaft position sensor range check (Low voltage, high voltage)
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not present	None

P0340: Camshaft Position Sensor Verify Pulse Input

Engine speed	600 rpm or more
Starter	OFF
Camshaft position sensor range check fail (P0342, P0343)	Not detected
Camshaft position sensor voltage	0.3 to 4.7 V
Lost communication of power management control ECU (U0293)	Not detected

P0342, P0343: Camshaft Position Sensor Range Check (Low Voltage, High Voltage)

Starter	OFF
Time after power switch OFF to on (IG)	2 seconds or more
Camshaft position sensor verify pulse input fail (P0340)	Not detected

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Battery voltage	8 V or more

TYPICAL MALFUNCTION THRESHOLDS

P0340: Camshaft Position Sensor Verify Pulse Input

Camshaft position and crankshaft position alignment	Misalignment
Camshaft position sensor signal	No signal

P0342: Camshaft Position Sensor Range Check (Low Voltage)

Camshaft position sensor voltage	Less than 0.3 V

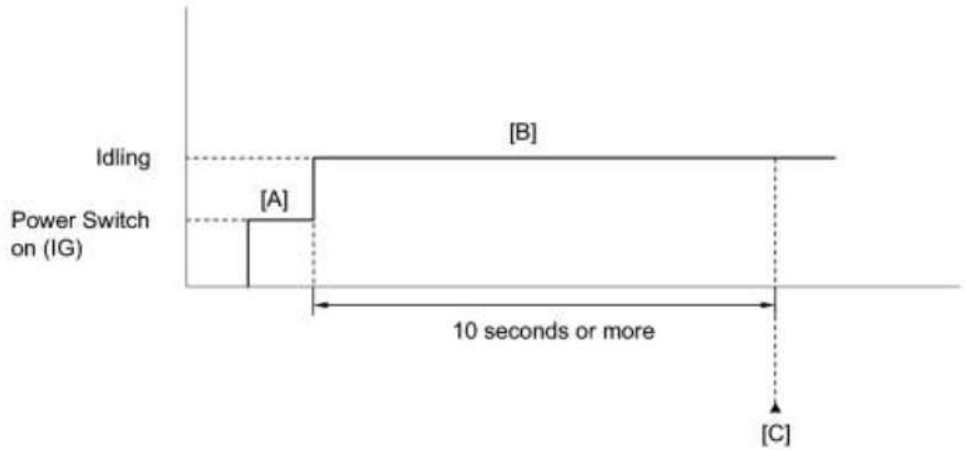
P0343: Camshaft Position Sensor Range Check (High Voltage)

Camshaft position sensor voltage	More than 4.7 V

COMPONENT OPERATING RANGE

Camshaft position sensor	Camshaft position sensor output voltage fluctuates while camshaft revolving 3 camshaft position sensor signals per 2 crankshaft revolutions
Camshaft position sensor voltage	0.3 to 4.7 V

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.

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2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine.
8. Idle the engine for 10 seconds or more [B].
9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
10. Read the DTC [C].
11. If a DTC is output, the system is malfunctioning.

HINT:

If a DTC is not output, perform the following procedure.

12. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
13. Input the DTC: P0340, P0342 or P0343.
14. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

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HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform step [B] again.

15. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
16. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

17. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0335 INFO.

INSPECTION PROCEDURE

HINT:

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.
- If no problem is found through this diagnostic troubleshooting procedure, troubleshoot the engine mechanical system.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0340, P0342 AND P0343)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result:

Result	Proceed to
DTC P0340, P0342 or P0343 is output	A
DTC P0340, P0342 or P0343 and other DTCs are output	B

HINT:

If any DTCs other than P0340, P0342 and P0343 are output, troubleshoot those DTCs first.

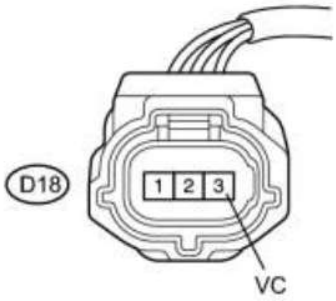
B ▶ GO TO DTC CHART

A ▼

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2.	INSPECT CAMSHAFT POSITION SENSOR (POWER SOURCE)

*1



(a) Disconnect the camshaft position sensor connector.

(b) Turn the power switch on (IG).

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
D18-3 (VC) - Body ground	Power switch on (IG)	4.5 to 5.0 V

Text in Illustration

*1	Front view of wire harness connector (to Camshaft Position Sensor)

(d) Reconnect the camshaft position sensor connector.

NG ▶ CHECK HARNESS AND CONNECTOR (CAMSHAFT POSITION SENSOR - ECM)

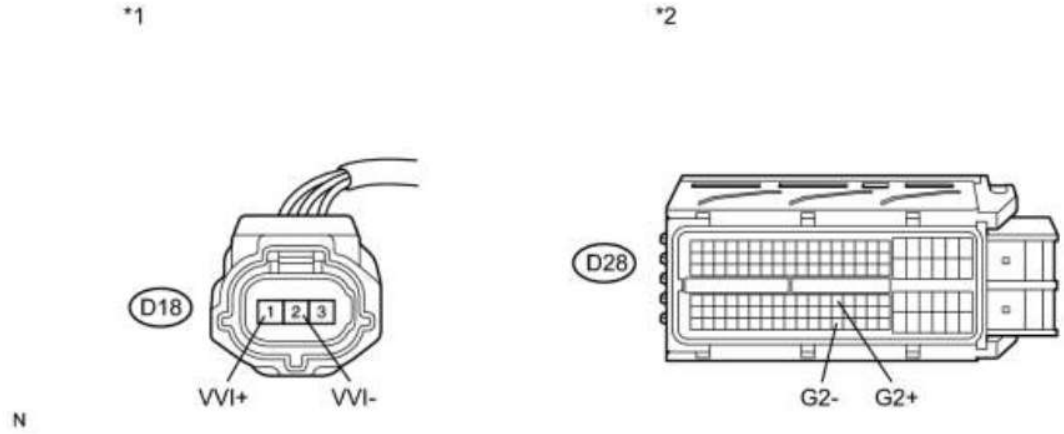
OK

▼

3.	CHECK HARNESS AND CONNECTOR (CAMSHAFT POSITION SENSOR - ECM)

(a) Disconnect the camshaft position sensor connector.

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(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D18-1 (VVI+) - D28-76 (G2+)	Always	Below 1 Ω
D18-2 (VVI-) - D28-122 (G2-)	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D18-1 (VVI+) or D28-76 (G2+) - Body ground	Always	10 kΩ or higher
D18-2 (VVI-) or D28-122 (G2-) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Camshaft Position Sensor)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the camshaft position sensor connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (CAMSHAFT POSITION SENSOR - ECM)

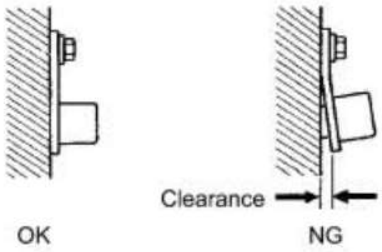
OK

▼

4.	CHECK SENSOR INSTALLATION (CAMSHAFT POSITION SENSOR)

(a) Check the camshaft position sensor installation.

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OK:

Sensor is installed correctly.

NG ▶ SECURELY REINSTALL SENSOR

OK ▼

5.	INSPECT INTAKE CAMSHAFT (TIMING ROTOR)

(a) Check the timing rotor of the intake camshaft.

OK:

Camshaft timing rotor does not have any cracks or deformation.

NG ▶ REPLACE INTAKE CAMSHAFT

OK ▼

6.	REPLACE CAMSHAFT POSITION SENSOR

(a) Replace the camshaft position sensor INFO.

NEXT ▼

7.	CHECK WHETHER DTC OUTPUT RECURS (P0340, P0342 OR P0343)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Put the engine in inspection mode INFO.

(f) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Read the DTCs.

Result:

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Result	Proceed to
DTC P0340, P0342 or P0343 is output	A
DTC is not output	B

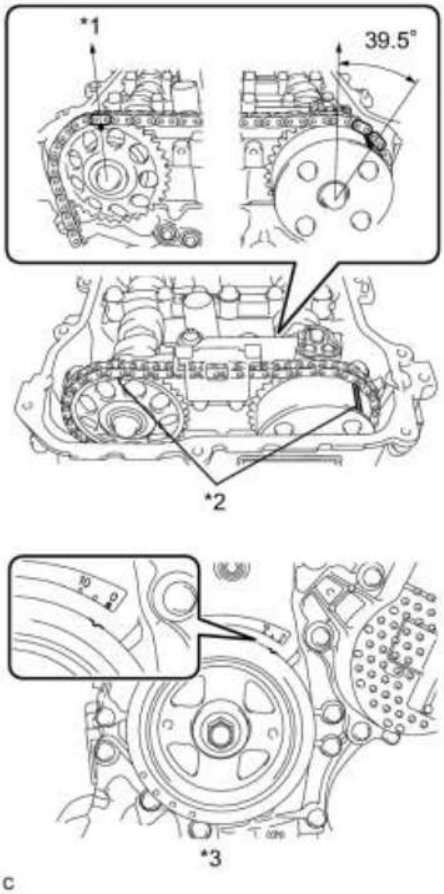
HINT:

If the engine does not start, replace the ECM.

B ▶ END

A ▼

8.	ADJUST VALVE TIMING



C

HINT:

There are no marks on the cylinder head to match-up for the purpose of checking valve timing. Valve timing can only be inspected by lining up the colored plates on the timing chain with the marks on the pulleys. It may be necessary to remove and reinstall the chain to match-up the alignment marks INFO.

Text in Illustration

*1	Top
*2	Alignment Mark
*3	No. 1 Cylinder at TDC Compression

NEXT ▼

9.	CHECK WHETHER DTC OUTPUT RECURS (P0340, P0342 OR P0343)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

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(e) Put the engine in inspection mode INFO.

(f) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble codes.

(h) Read the DTCs.

Result:

Result	Proceed to
DTC is not output	A
DTC P0340, P0342 or P0343 is output	B

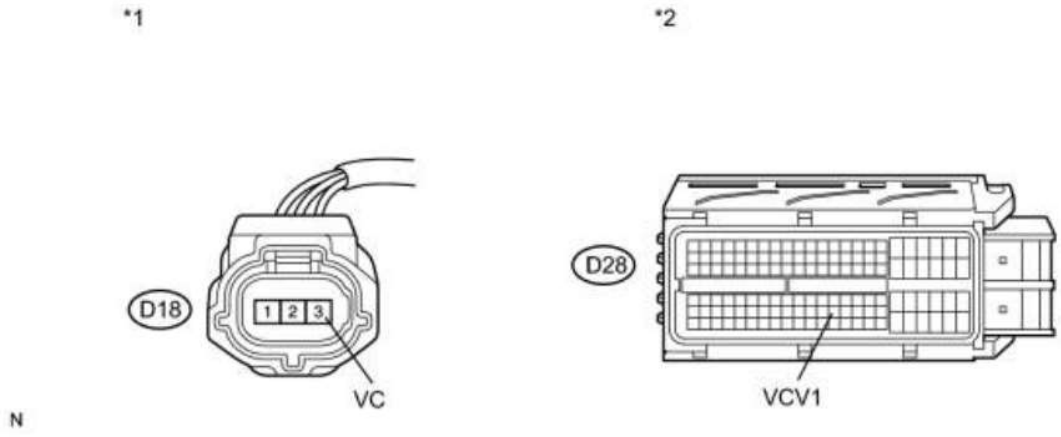
HINT:

If the engine does not start, replace the ECM.

B ▶ REPLACE ECM
A ▶ **END**

10.	CHECK HARNESS AND CONNECTOR (CAMSHAFT POSITION SENSOR - ECM)

(a) Disconnect the camshaft position sensor connector.



(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D18-3 (VC) - D28-99 (VCV1)	Always	Below 1 Ω

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Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D18-3 (VC) or D28-99 (VCV1) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Camshaft Position Sensor)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the camshaft position sensor connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (CAMSHAFT POSITION SENSOR - ECM)
OK ▶ **REPLACE ECM**

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DTC	P0351	Ignition Coil "A" Primary / Secondary Circuit
DTC	P0352	Ignition Coil "B" Primary / Secondary Circuit
DTC	P0353	Ignition Coil "C" Primary / Secondary Circuit
DTC	P0354	Ignition Coil "D" Primary / Secondary Circuit

DESCRIPTION

HINT:

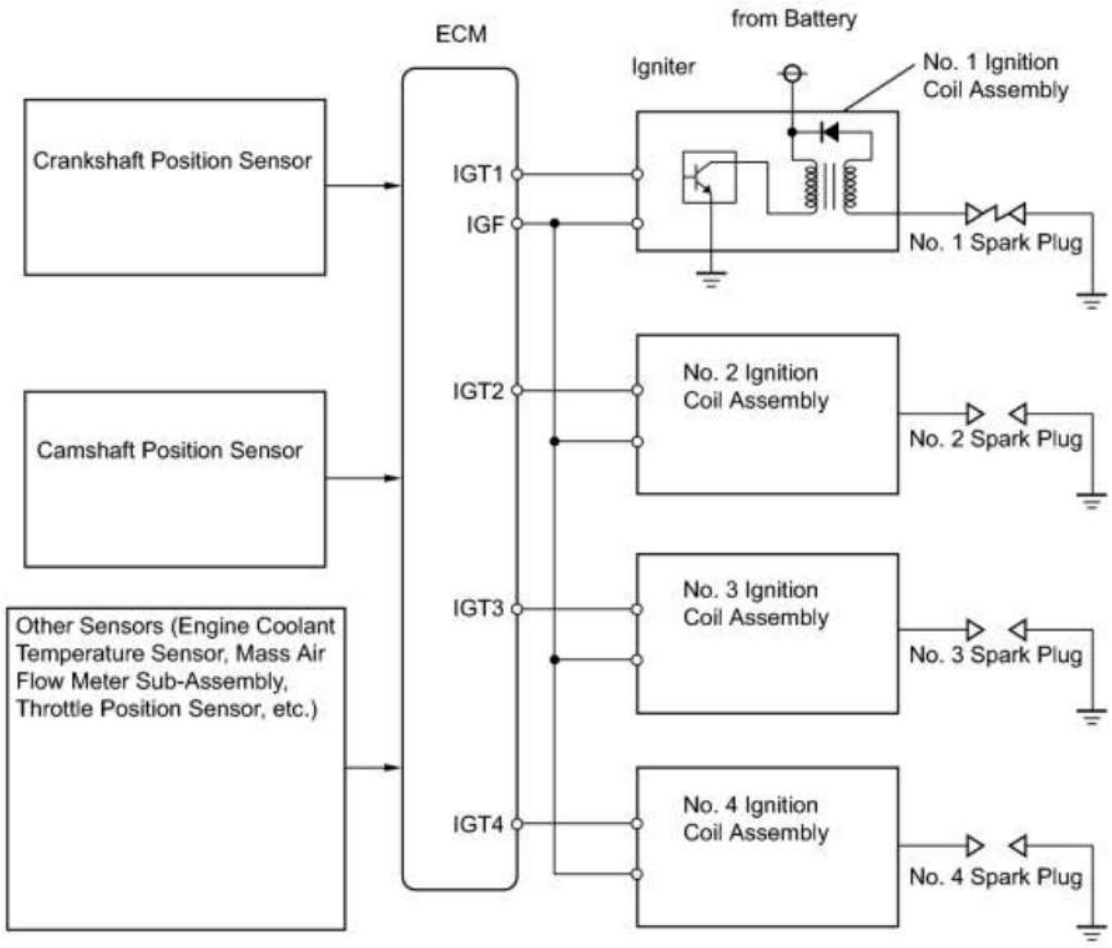
- These DTCs indicate malfunctions relating to the primary circuit.
- If DTC P0351 is set, check the No. 1 ignition coil assembly circuit.
- If DTC P0352 is set, check the No. 2 ignition coil assembly circuit.
- If DTC P0353 is set, check the No. 3 ignition coil assembly circuit.
- If DTC P0354 is set, check the No. 4 ignition coil assembly circuit.

A Direct Ignition System (DIS) is used on this vehicle.

The DIS is an ignition system in which each cylinder is ignited by it's own ignition coil assembly and spark plug. The secondary wiring of each ignition coil generates a powerful voltage which is applied directly to each spark plug. The spark passes from the center electrode of the spark plug to the ground electrode.

The ECM determines the ignition timing and transmits the ignition (IGT) signals to each cylinder. Using the IGT signal, the ECM turns the power transistor inside the igniter on and off. The power transistor, in turn, switches on and off the current to the primary coil. When the current to the primary coil is cut off, a powerful voltage is generated in the secondary coil. This voltage is applied to the spark plugs, causing them to spark inside the cylinders. As the ECM cuts the current to the primary coil, the igniter sends back an ignition confirmation (IGF) signal to the ECM, for each cylinder ignition.

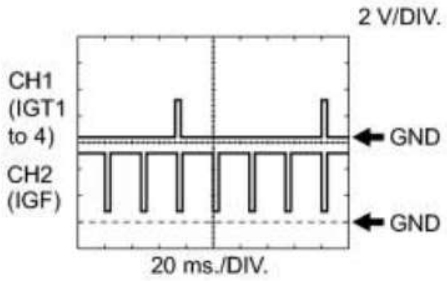
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Y

DTC No.	DTC Detection Conditions	Trouble Areas
P0351 P0352 P0353 P0354	No IGF signal to ECM while engine running (1 trip detection logic)	• Ignition system • Open or short in IGF or IGT circuit (1 to 4) between ignition coil assembly and ECM • No. 1 to No. 4 ignition coil assemblies • ECM

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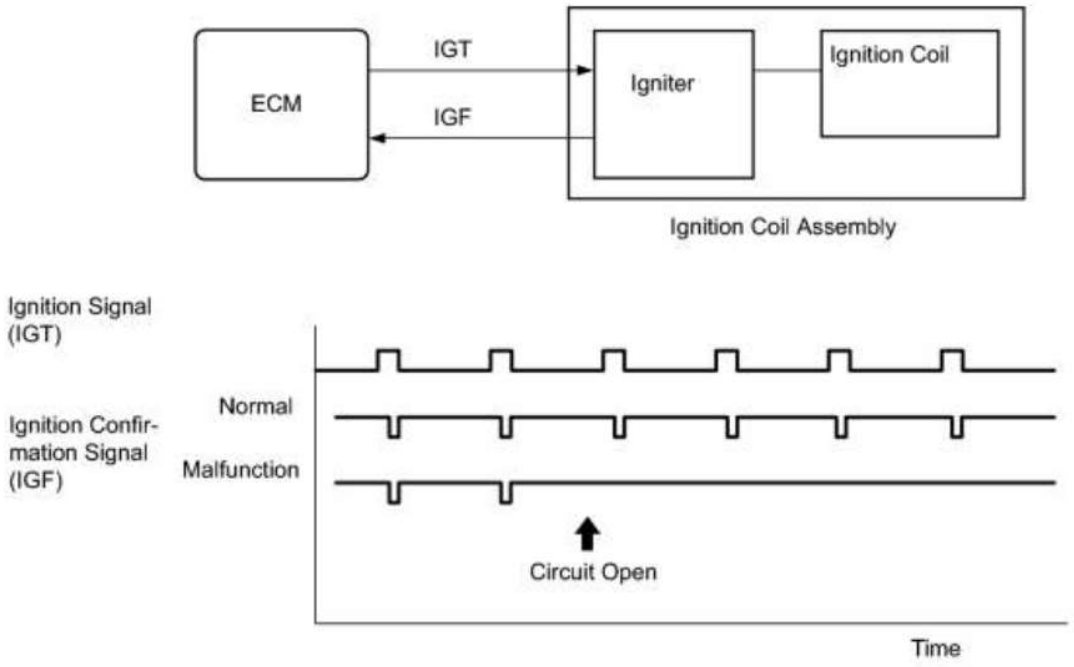


- Reference: Inspection using an oscilloscope.
- While cranking or idling the engine, check the waveform between terminals IGT (1 to 4) and E1, and IGF and E1 of the ECM connector.

ECM Terminal Name	Between IGT (1 to 4) and E1 Between IGF and E1
Tester Range	2 V/DIV., 20 ms./DIV.
Condition	Idling

MONITOR DESCRIPTION

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Y

If the ECM does not receive any IGF signals despite transmitting the IGT signal, it interprets this as a fault in the igniter and sets a DTC.

If the malfunction is not repaired successfully, a DTC is set 1 second after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0351: Igniter (cylinder 1) malfunction P0352: Igniter (cylinder 2) malfunction P0353: Igniter (cylinder 3) malfunction P0354: Igniter (cylinder 4) malfunction
Required Sensors/Components (Main)	Igniter
Required Sensors/Components (Related)	Crankshaft position sensor
Frequency of Operation	Continuous
Duration	0.256 seconds
MIL Operation	Immediately

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Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
Either of the following conditions A or B is met	-
A. Engine speed	1500 rpm or less
B. Starter	OFF
Either of the following conditions C or D met	-
C. Both of the following conditions (a) and (b) are met	-
(a) Engine speed	500 rpm or less
(b) Battery voltage	6 V or more
D. All of the following conditions (c), (d) and (e) are met	-
(c) Engine speed	More than 500 rpm
(d) Battery voltage	10 V or more
(e) Number of sparks after CPU reset	5 sparks or more
Lost communication with power management control ECU (U0293)	Not detected

TYPICAL MALFUNCTION THRESHOLDS

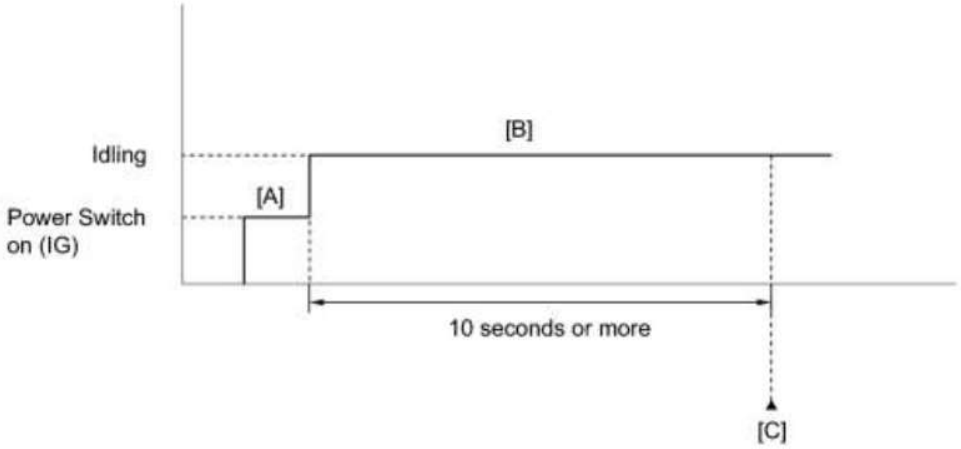
All of the following conditions are met	Conditions A, B and C
A. Ignition signal fail counter	More than 2 times
B. Time after condition A is met	0.256 seconds or more
C. Ignition signal fail count after condition B is met	More than 2 times

COMPONENT OPERATING RANGE

Confirmed ignition signal input when ignition signal is ON to OFF	2 times

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine.
8. Idle the engine for 10 seconds or more [B].
9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
10. Read the DTC [C].
11. If a DTC is output, the system is malfunctioning.

    HINT:

    If a DTC is not output, perform the following procedure.

12. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
13. Input the DTC: P0351, P0352, P0353 or P0354.
14. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed

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Techstream Display	Description
	○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform step [B] again.

15. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
16. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

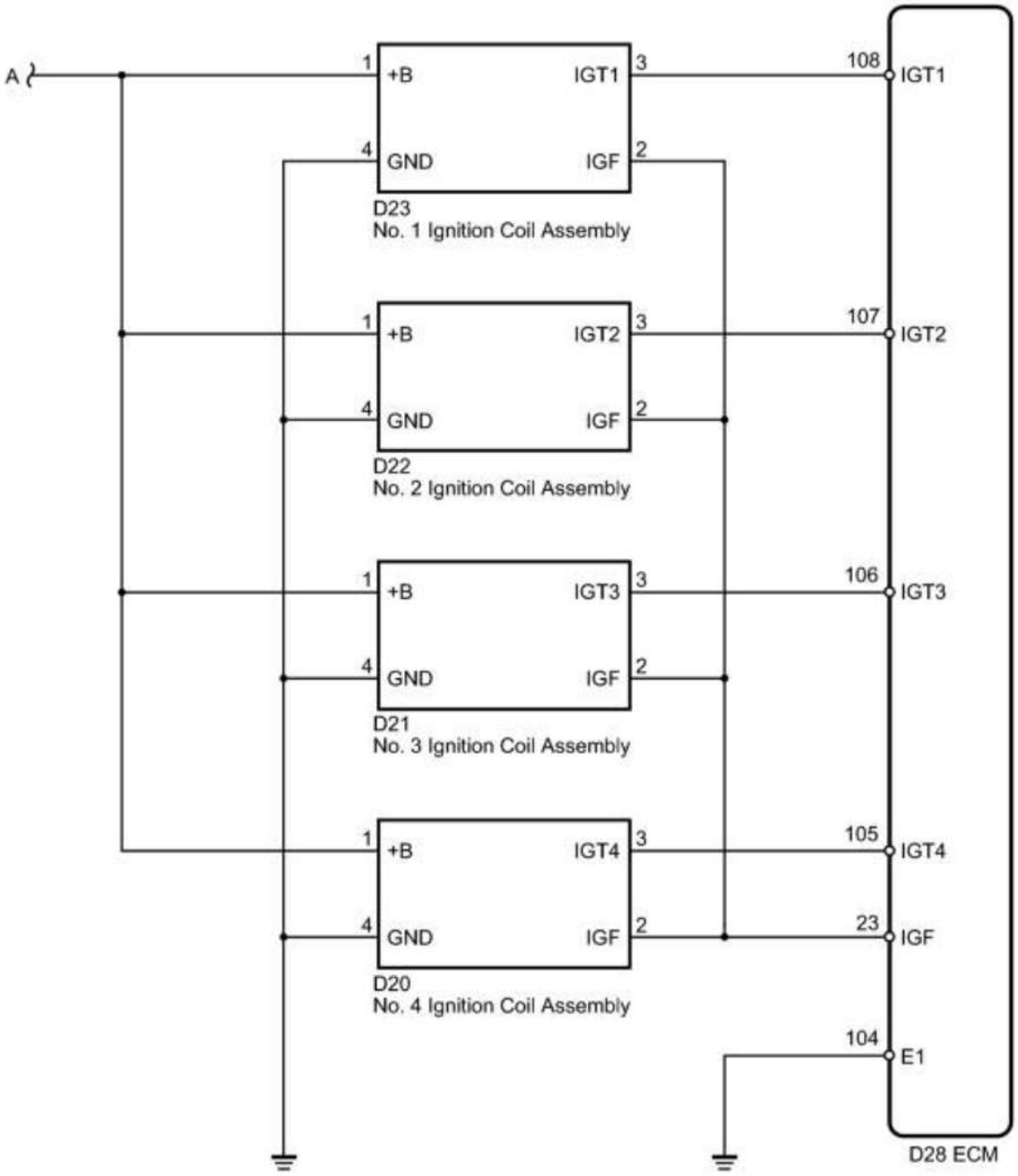
17. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

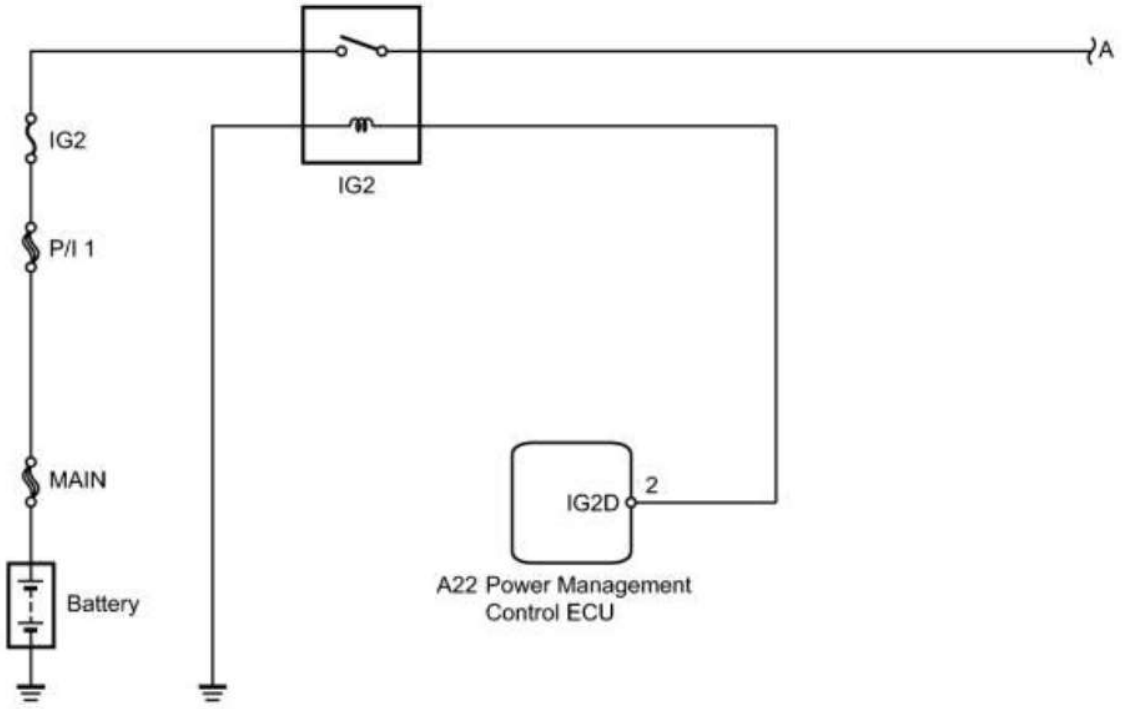
- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	CHECK HARNESS AND CONNECTOR (IGNITION COIL ASSEMBLY - BODY GROUND)

(a) Disconnect the ignition coil assembly connectors.

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*1



N

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D23-4 (GND) - Body ground	Always	Below 1 Ω
D22-4 (GND) - Body ground	Always	Below 1 Ω
D21-4 (GND) - Body ground	Always	Below 1 Ω
D20-4 (GND) - Body ground	Always	Below 1 Ω

Text in Illustration

*1	Front view of wire harness connector (to Ignition Coil Assembly)

(c) Reconnect the ignition coil assembly connectors.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (IGNITION COIL ASSEMBLY - BODY GROUND)

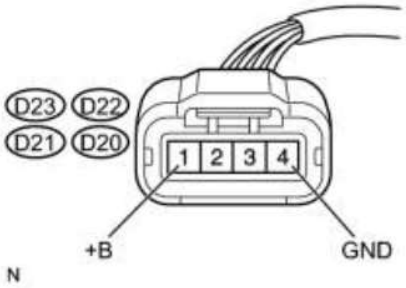
OK ▼

2.	INSPECT IGNITION COIL ASSEMBLY (POWER SOURCE)

(a) Disconnect the ignition coil assembly connectors.

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*1



(b) Turn the power switch on (IG).

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Condition	Specified Condition
D23-1 (+B) - D23-4 (GND)	Power switch on (IG)	11 to 14 V
D22-1 (+B) - D22-4 (GND)	Power switch on (IG)	11 to 14 V
D21-1 (+B) - D21-4 (GND)	Power switch on (IG)	11 to 14 V
D20-1 (+B) - D20-4 (GND)	Power switch on (IG)	11 to 14 V

Text in Illustration

*1	Front view of wire harness connector (to Ignition Coil Assembly)

(d) Reconnect the ignition coil assembly connectors.

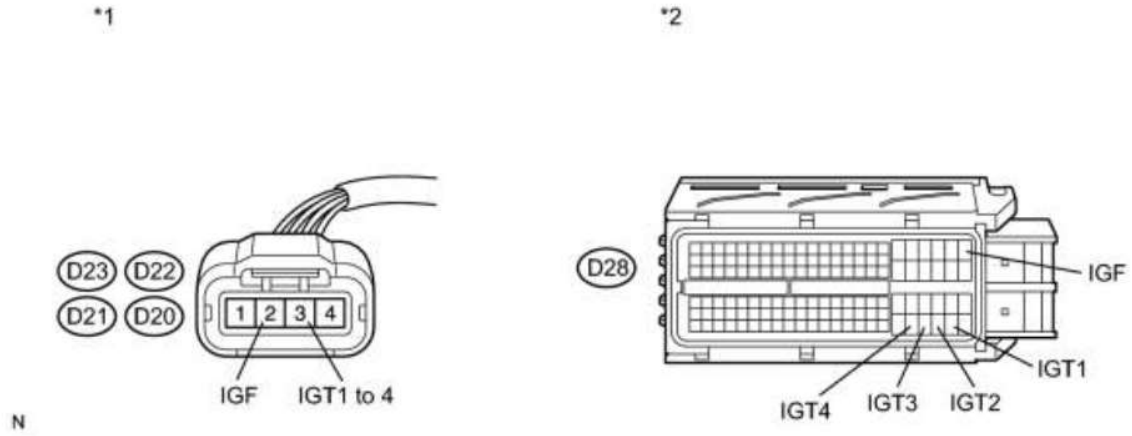
NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (IGNITION COIL ASSEMBLY - IG2 RELAY)

OK ▼

3.	CHECK HARNESS AND CONNECTOR (IGNITION COIL ASSEMBLY - ECM)

(a) Disconnect the ignition coil assembly connectors.

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(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D23-2 (IGF) - D28-23 (IGF)	Always	Below 1 Ω
D22-2 (IGF) - D28-23 (IGF)	Always	Below 1 Ω
D21-2 (IGF) - D28-23 (IGF)	Always	Below 1 Ω
D20-2 (IGF) - D28-23 (IGF)	Always	Below 1 Ω

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D23-3 (IGT1) - D28-108 (IGT1)	Always	Below 1 Ω
D22-3 (IGT2) - D28-107 (IGT2)	Always	Below 1 Ω
D21-3 (IGT3) - D28-106 (IGT3)	Always	Below 1 Ω
D20-3 (IGT4) - D28-105 (IGT4)	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D23-2 (IGF) or D28-23 (IGF) - Body ground	Always	10 kΩ or higher
D22-2 (IGF) or D28-23 (IGF) - Body ground	Always	10 kΩ or higher
D21-2 (IGF) or D28-23 (IGF) - Body ground	Always	10 kΩ or higher
D20-2 (IGF) or D28-23 (IGF) - Body ground	Always	10 kΩ or higher

Standard Resistance (Check for Short):

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Tester Connection	Condition	Specified Condition
D23-3 (IGT1) or D28-108 (IGT1) - Body ground	Always	10 kΩ or higher
D22-3 (IGT2) or D28-107 (IGT2) - Body ground	Always	10 kΩ or higher
D21-3 (IGT3) or D28-106 (IGT3) - Body ground	Always	10 kΩ or higher
D20-3 (IGT4) or D28-105 (IGT4) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Ignition Coil Assembly)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the ECM connector.

(e) Reconnect the ignition coil assembly connectors.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (IGNITION COIL ASSEMBLY - ECM)

OK

▼

4.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0351, P0352, P0353 OR P0354)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Shuffle arrangement of the ignition coil assemblies (among No. 1 to No. 4 cylinders).

NOTICE:

Do not shuffle the connectors.

(f) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Read the DTCs.

Result:

Result	Proceed to
Same DTC output	A
Different ignition coil DTC output	B

B ▶ REPLACE IGNITION COIL ASSEMBLY

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A REPLACE ECM

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DTC	P0401	Exhaust Gas Recirculation Flow Insufficient Detected

DESCRIPTION

Based on the driving conditions, the ECM regulates the volume of exhaust gas that is recirculated to the engine's combustion chambers and thus lowers the combustion temperature to reduce NOx emissions. The ECM monitors signals such as engine speed, coolant temperature, electric load, and vehicle speed. When the EGR permission conditions are fulfilled, the ECM controls the opening of the EGR valve linearly through signals to the EGR step motor.

DTC No.	DTC Detection Condition	Trouble Area
P0401	Change in intake manifold pressure is small when the EGR valve is opened and closed during idle fuel cut operation. (2 trip detection logic)	• EGR valve assembly • EGR passage • EGR with cooler pipe sub-assembly • Manifold absolute pressure sensor • ECM

MONITOR DESCRIPTION

The ECM monitors the pressure inside the intake manifold while opening and closing the EGR valve during fuel cut operation. If there is no change in the manifold absolute pressure sensor value, the ECM interprets this as a malfunction in the EGR valve assembly, illuminates the MIL and stores the DTC (2 trip detection logic).

MONITOR STRATEGY

Related DTC	P0401: EGR valve high flow rate / low flow rate
Required sensors / components (Main)	EGR valve assembly, manifold absolute pressure sensor
Required sensors / components (Related)	Engine coolant temperature sensor, vehicle speed sensor
Frequency of operation	Continuous
Duration	3 seconds
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
Time after engine started	3 seconds or more
Time after engine fuel cut	2000 msec or more
Engine speed	950 to 1600 rpm
Vehicle speed	12.5 mph (20 km/h) or more

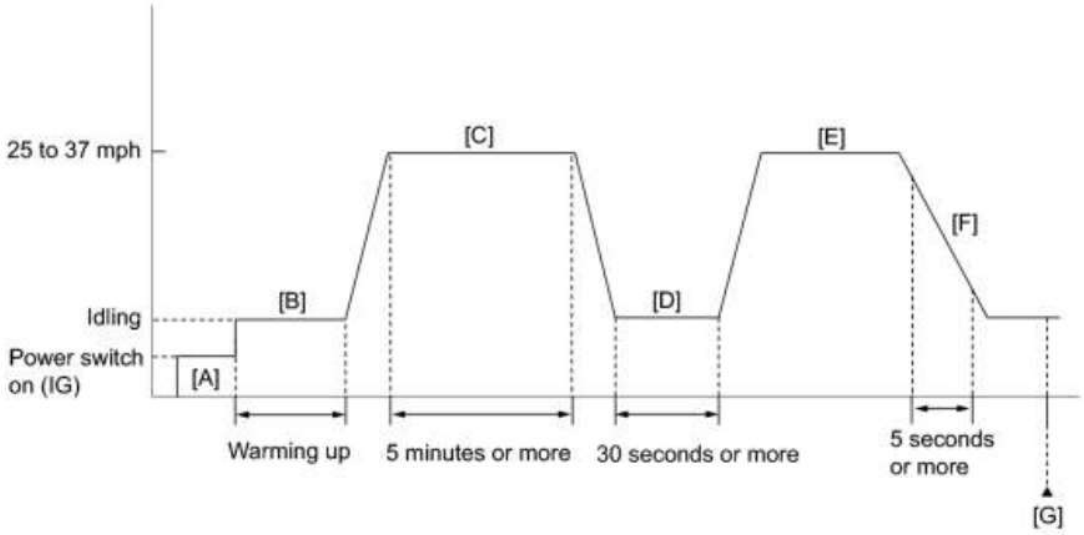
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Engine speed change	-20 to 20 rpm
Time after engine load becomes stable (HVAC, Brake, Lockup)	More than 1.2 sec
Engine coolant temperature	70°C (158°F) or more
Battery voltage	11 V or more
Intake air temperature	-10°C (14°F) or more
Atmospheric pressure	76 kPa or more

TYPICAL MALFUNCTION THRESHOLDS

Manifold pressure change	Less than 1.0 kPa
At engine speed	1050 rpm

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine and warm it up until the engine coolant temperature reaches 70°C (158°F) or more [B].

   HINT:

   The A/C switch and all accessory switches should be off and shift lever in P or N.

8. Drive the vehicle at 25 to 37 mph (40 to 60 km/h) for 5 minutes or more [C].
9. Idle the engine for 30 seconds or more [D].

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10. Accelerate the vehicle to 25 to 37 mph (40 to 60 km/h) with the shift lever in B [E].
11. Perform fuel cut operation for 5 seconds or more, with the accelerator pedal fully released [F].

    CAUTION:

    When performing the confirmation driving pattern, obey all speed limits and traffic laws.

    HINT:

    When fuel cut is operating "Idle Fuel Cut" in Data List is ON.

12. Enter the following menus: Powertrain / Engine and ECT / Monitor / Exhaust Gas Recirculation/VVT / Status2 [G].
13. Check that the Exhaust Gas Recirculation/VVT / Status2 monitor is Complete.

    HINT:

    If the monitor is Incomplete, perform the driving pattern again.

14. Enter the following menus: Powertrain / Engine and ECT / Monitor / Exhaust Gas Recirculation/VVT/Details.
15. Check the Details (EGR FLOW INSUFFICIENCY).

    HINT:

    Make sure that the value is between MIN and MAX.

16. If the monitor is still Incomplete, perform the following procedure.
17. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
18. Read Pending DTCs.
19. If a pending DTC is output, the system is malfunctioning,

    HINT:

    If a pending DTC is not output, perform the following procedure.

20. Enter the following menus: Power train / Engine and ECT / Utility / All Readiness.
21. Input the DTC: P0401.
22. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed

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Techstream Display	Description
	○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgement result shows NORMAL, the system is normal.
- If the DTC judgment result is INCOMPLETE or UNKNOWN and no pending DTC is output, accelerate the vehicle again at 25 to 37 mph (40 to 60 km/h) with the shift lever in B, perform fuel cut operation for 5 seconds or more with the accelerator pedal fully released, and check the DTC judgment result.

23. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

- By using the Control the EGR Step Position Active Test, the operation of the EGR valve can be checked.
- When the engine is idling steadily with the EGR valve fully closed, if the EGR valve is normal and it is opened using the Active Test, the Data List value changes as follows.

Data List	Change in Data List when Number of Steps is Increased Using Control the EGR Step Position Active Test
Engine Speed	Idle becomes rough
MAP	Pressure rises

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

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1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO P0401)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTC.

Result:

Result	Proceed to
DTC P0401 is output	A
DTC P0401 and other DTCs are output	B

B ▶ GO TO DTC CHART

A ▼

2.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off and shift lever in P or N.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

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MAP and idling condition change in response to EGR step position as follows.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling or engine stalls
MAP (Data List)	-	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

Result:

Result	Proceed to
Outside of standard range	A
Within standard range	B

NG ▶ REPLACE EGR VALVE ASSEMBLY

OK ▼

3.	INSPECT EGR VALVE ASSEMBLY

(a) Check if the EGR valve are clogged with deposits.

(b) Check if the EGR valve is closed.

OK:

EGR valve is closed and no deposits.

Result:

Result	Proceed to
NG	A
OK	B

B ▶ CHECK FOR DEPOSIT (INTAKE PORT TO EGR VALVE ASSEMBLY)

A ▼

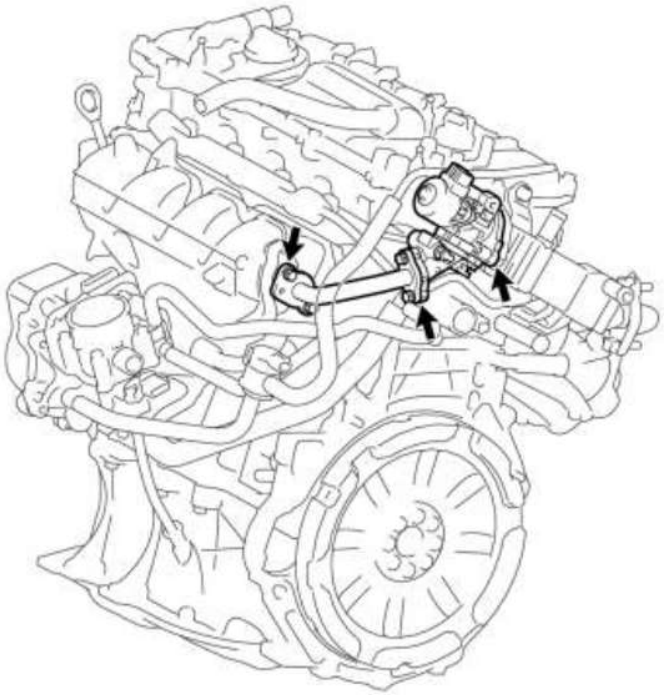
4.	REPLACE EGR VALVE ASSEMBLY

(a) Replace the EGR valve assembly INFO.

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NEXT

5.	CHECK FOR DEPOSIT (INTAKE PORT TO EGR VALVE ASSEMBLY)



P

(a) Check for exhaust leaks at each connection point.

(b) Check for cracks, damage, and clogs in the pipes between the intake manifold and the EGR valve assembly.

(c) This check may require the removal of components.

(d) Check if there is a built-up of deposits in the EGR valve of pipes.

OK:

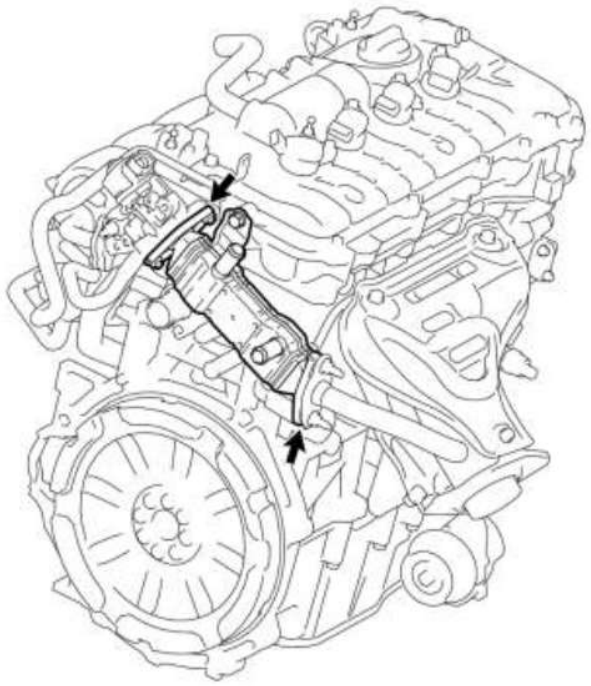
No deposits.

NG ▶ REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA

OK

6.	CHECK FOR DEPOSIT (EXHAUST MANIFOLD SUB-ASSEMBLY TO EGR VALVE ASSEMBLY)

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P

(a) Check for exhaust leaks at each connection point.

(b) Check for cracks, damage, and clogs in the pipes between the exhaust manifold sub-assembly and the EGR valve assembly.

(c) This check may require the removal of components.

(d) Check if there is a built-up of deposits in the EGR valve of pipes.

OK:

No deposits.

NG ▶ REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA

OK ▼

7.	INSPECT EGR WITH COOLER PIPE SUB-ASSEMBLY

(a) Check for blockage of the EGR with cooler pipe sub-assembly.

NG ▶ REPAIR OR REPLACE EGR WITH COOLER PIPE SUB-ASSEMBLY

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OK

8.	READ VALUE USING TECHSTREAM (MANIFOLD ABSOLUTE PRESSURE SENSOR)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / MAP.

(e) Read the MAP value.

Standard:

Switch Condition	Techstream Display
Power switch on (IG)	80 to 110 kPa (600 to 825 mmHg)

(f) Put the engine in inspection mode INFO.

(g) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

(h) Enter the following menus: Powertrain / Engine and ECT / Data List / MAP.

(i) Read the MAP value when idling the engine with the A/C switch and all accessory switches should be off and shift lever in P or N.

Standard:

Engine Condition	Techstream Display
Idling	Less than 80 kPa (600 mmHg)

Result:

Result	Proceed to
NG	A
OK	B

B CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

A

9.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO.

OK:

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No leaks in intake system.

NG ▶ REPAIR OR REPLACE INTAKE SYSTEM

OK

▼

10.	REPLACE MANIFOLD ABSOLUTE PRESSURE SENSOR

(a) Replace the manifold absolute pressure sensor INFO.

NEXT

▼

11.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTC INFO.

(e) Turn the power switch off and wait for 30 seconds.

(f) Turn the power switch on (IG) and turn the Techstream on.

(g) Put the engine in inspection mode INFO.

(h) Start the engine and warm it up until the engine coolant temperature reaches 70°C (158°F) or more.

HINT:

The A/C switch and all accessory switches should be off and shift lever in P or N.

(i) Drive the vehicle at 25 to 37 mph (40 to 60 km/h) with the shift lever in B.

CAUTION:

Strictly observe speed limits and traffic laws when performing the confirmation drive pattern.

(j) Perform fuel cut operation for 5 seconds or more with the accelerator pedal fully released.

HINT:

If the deceleration was not completed, perform the Confirmation Driving Pattern again.

(k) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(l) Read Pending DTC.

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(m) If the pending DTC is output, the system is malfunctioning.

HINT:

If a pending DTC is not output, perform the following procedure.

(n) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(o) Input the DTC: P0401.

(p) Check the DTC judgment result.

Techstream Display	Description
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

If the pending DTC is not output and the DTC judgment result is INCOMPLETE or UNKNOWN, drive the vehicle again at 25 to 37 mph (40 to 60 km/h) with the shift lever in B, perform fuel cut operation for 5 seconds or more with the accelerator pedal fully released, and check the DTC judgment result.

NEXT ▶ **END**

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DTC	P0403	Exhaust Gas Recirculation Control Circuit

DESCRIPTION

Refer to DTC P0401 INFO.

DTC No.	DTC Detection Condition	Trouble Area
P0403	Open or short in EGR valve circuit (1 trip detection logic)	• Open or short in EGR circuit • EGR valve assembly • ECM

HINT:

DTC P0403 is set when the power switch is on (IG).

MONITOR DESCRIPTION

This DTC is designed to detect an open or short in the EGR valve assembly circuit.

Example:

- If the EGR1, EGR2, EGR3 or EGR4 terminal output voltage is excessively low, but the step motor is still operating, the ECM determines that there is a short in the EGR valve assembly circuit , and sets the DTC.
- If the EGR1, EGR2, EGR3 or EGR4 terminal output voltage is excessively low, and the step motor is not operating, the ECM determines that there is an open in the EGR valve assembly circuit, and sets the DTC.

MONITOR STRATEGY

Related DTCs	P0403: EGR valve circuit range check
Required sensors / components (Main)	EGR valve assembly
Required sensors / components (Related)	-
Frequency of operation	Continuous
Duration	0.5 seconds
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
Engine	Running
Battery voltage	10.5 V or more

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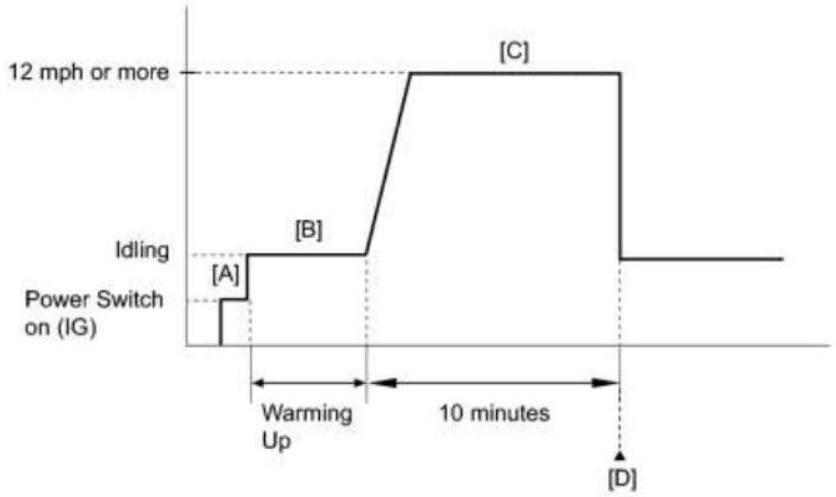
Time after power switch off to on (IG)	More than 0.5 seconds

TYPICAL MALFUNCTION THRESHOLDS

One of the following conditions is met:	Conditions A, B, C or D
A. All of the conditions are met:	Conditions 1 and 2
1. EGR1 output terminal voltage	Low voltage
2. Either of the following conditions is met:	Condition (a) or (b)
(a) Step motor	Driving
(b) EGR1	Not operating
B. All of the following conditions are met:	Conditions 3 and 4
3. EGR2 output terminal voltage	Low voltage
4. Either of the following conditions is met:	Condition (c) or (d)
(c) Step motor	Driving
(d) EGR2	Not operating
C. All of the following conditions are met:	Conditions 5 and 6
5. EGR3 output terminal voltage	Low voltage
6. Either of the following conditions is met:	Condition (e) or (f)
(e) Step motor	Driving
(f) EGR3	Not operating
D. All of the following conditions are met:	Conditions 7 and 8
7. EGR4 output terminal voltage	Low voltage
8. Either of the following conditions is met:	Condition (g) or (h)
(g) Step motor	Driving
(h) EGR4	Not operating

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CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine and warm it up [B].
8. Drive the vehicle at 12 mph (20 km/h) or more for 10 minutes [C].
9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
10. Read the DTCs [D].
11. If the DTC P0403 is output, the system is malfunction.

    HINT:

    If a DTC is not output, perform the following procedure.

12. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
13. Input the DTC: P0403.
14. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed

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Techstream Display	Description
	○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system has a normal.

15. If the test result is INCOMPLETE or UNKNOWN, drive the vehicle at 12 mph (20 km/h) or more for 10 minutes, and check the DTC judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system has a normal.

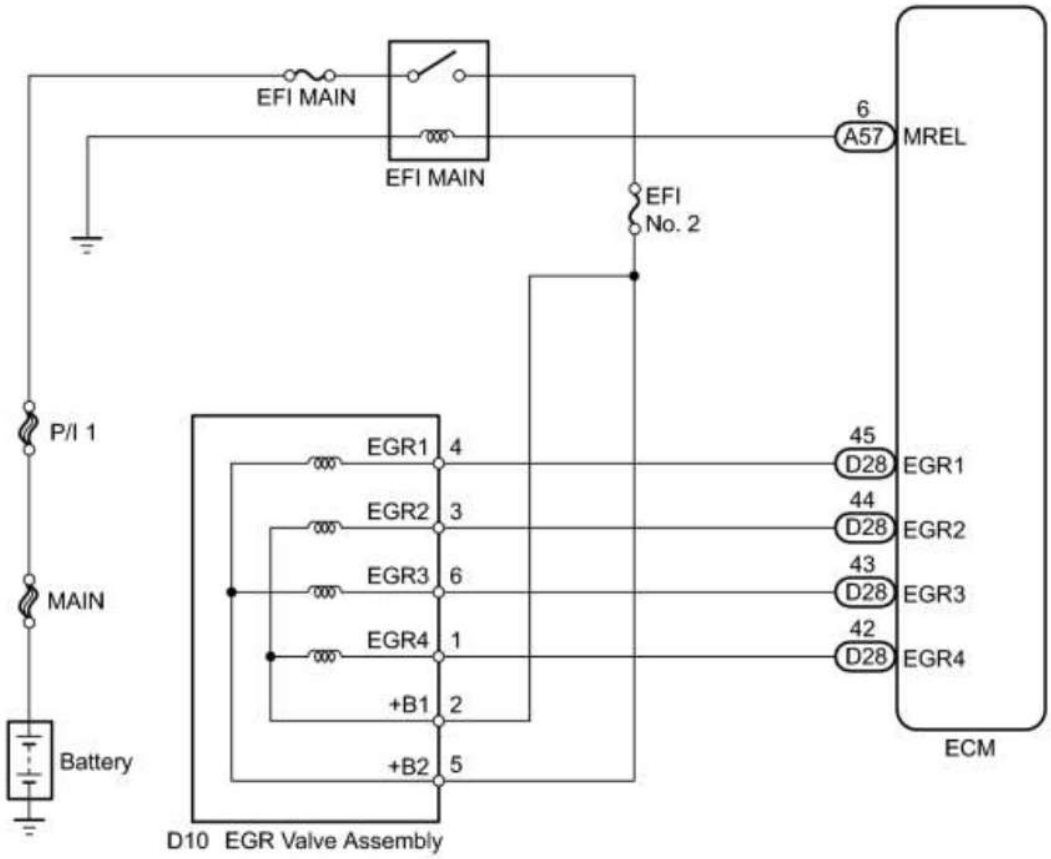
16. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

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(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

Result:

Result	Proceed to
Within standard range	A
Outside of standard range	B

B ▶ INSPECT EGR VALVE ASSEMBLY

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A **CHECK FOR INTERMITTENT PROBLEMS**

2.	INSPECT EGR VALVE ASSEMBLY

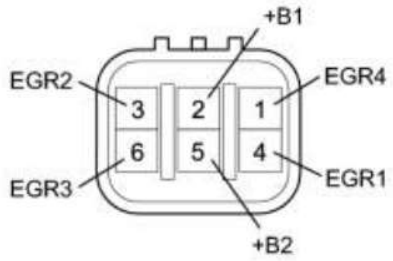
(a) Disconnect the EGR valve assembly connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
2 (+B1) - 3 (EGR2)	20 °C (68 °F)	20 to 22 Ω
2 (+B1) - 1 (EGR4)		
5 (+B2) - 4 (EGR1)		
5 (+B2) - 6 (EGR3)		

*1



C

Text in Illustration

*1	Component without harness connected (EGR Valve Assembly)

(c) Reconnect the EGR valve assembly connector.

NG ▶ REPLACE EGR VALVE ASSEMBLY

OK ▼

3.	INSPECT EGR VALVE ASSEMBLY (+B1 OR +B2 VOLTAGE)

(a) Disconnect the EGR valve assembly connector.

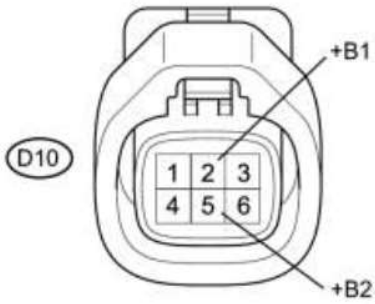
(b) Turn the power switch on (IG).

(c) Measure the voltage according to the value(s) in the table below.

*1

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
D10-2 (+B1) - Body ground	Power switch on (IG)	11 to 14 V
D10-5 (+B2) - Body ground		



C

Text in Illustration

*1	Front view of wire harness connector (to EGR Valve Assembly)

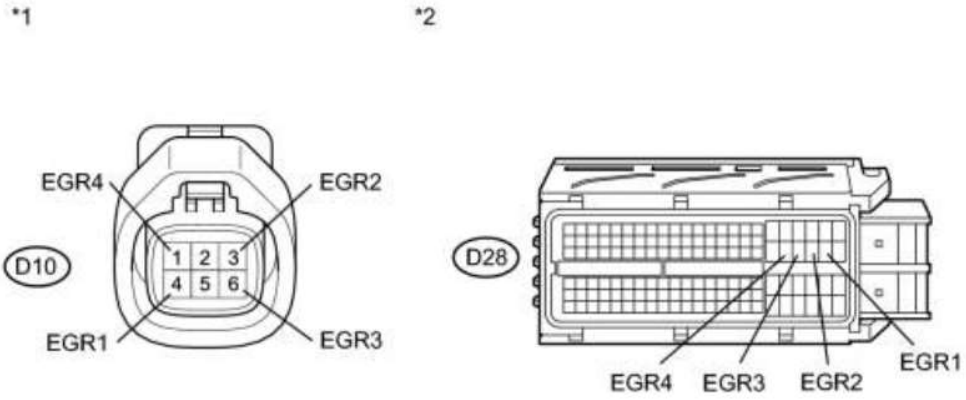
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(d) Reconnect the EGR valve assembly connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (EGR VALVE ASSEMBLY - EFI MAIN RELAY)

OK ▼

4.	CHECK HARNESS AND CONNECTOR (ECM - EGR VALVE ASSEMBLY)



(a) Disconnect the EGR valve assembly connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D28-45 (EGR1) - D10-4 (EGR1)	Always	Below 1 Ω
D28-44 (EGR2) - D10-3 (EGR2)		
D28-43 (EGR3) - D10-6 (EGR3)		
D28-42 (EGR4) - D10-1 (EGR4)		

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D28-45 (EGR1) or D10-4 (EGR1) - Body ground	Always	10 kΩ or higher
D28-44 (EGR2) or D10-3 (EGR2) - Body ground		
D28-43 (EGR3) or D10-6 (EGR3) - Body ground		
D28-42 (EGR4) or D10-1 (EGR4) - Body ground		

Text in Illustration

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*1	Front view of wire harness connector (to EGR Valve Assembly)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the ECM connector.

(e) Reconnect the EGR valve assembly connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - EGR VALVE ASSEMBLY)
OK
▼

5.	CHECK DTC OUTPUT RECORDS (DTC P0403)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG) and turn the Techstream on.

(c) Clear the DTCs INFO.

(d) Put the engine in inspection mode INFO.

(e) Start the engine warm it up.

(f) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Read the DTCs.

Result:

Result	Proceed to
DTC is not output	A
DTC P0403 is output	B

B ▶ REPLACE ECM
A ▶ **END**

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DTC	P0420	Catalyst System Efficiency Below Threshold (Bank 1)

MONITOR DESCRIPTION

The ECM uses sensors mounted in front of and behind the three-way catalytic converter to monitor its efficiency.

The first sensor, the air fuel ratio sensor, sends pre-catalyst information to the ECM. The second sensor, the heated oxygen sensor, sends post-catalyst information to the ECM.

In order to detect any deterioration in the three-way catalytic converter, the ECM calculates the oxygen storage capacity of the three-way catalytic converter. This calculation is based on the voltage output of the heated oxygen sensor while performing active air fuel ratio control.

The oxygen storage capacity value is an indication of the oxygen storage capacity of the three-way catalytic converter. When the vehicle is being driven with a warm engine, active air fuel ratio control is performed for approximately 15 to 20 seconds. When it is performed, the ECM deliberately sets the air fuel ratio to lean or rich levels. If the cycle of the waveform for the heated oxygen sensor is long, the oxygen storage capacity is great. There is a direct correlation between the heated oxygen sensor and the oxygen storage capacity of the three-way catalytic converter.

The ECM uses the oxygen storage capacity value to determine the state of the three-way catalytic converter. If any deterioration has occurred, it illuminates the MIL and sets the DTC.

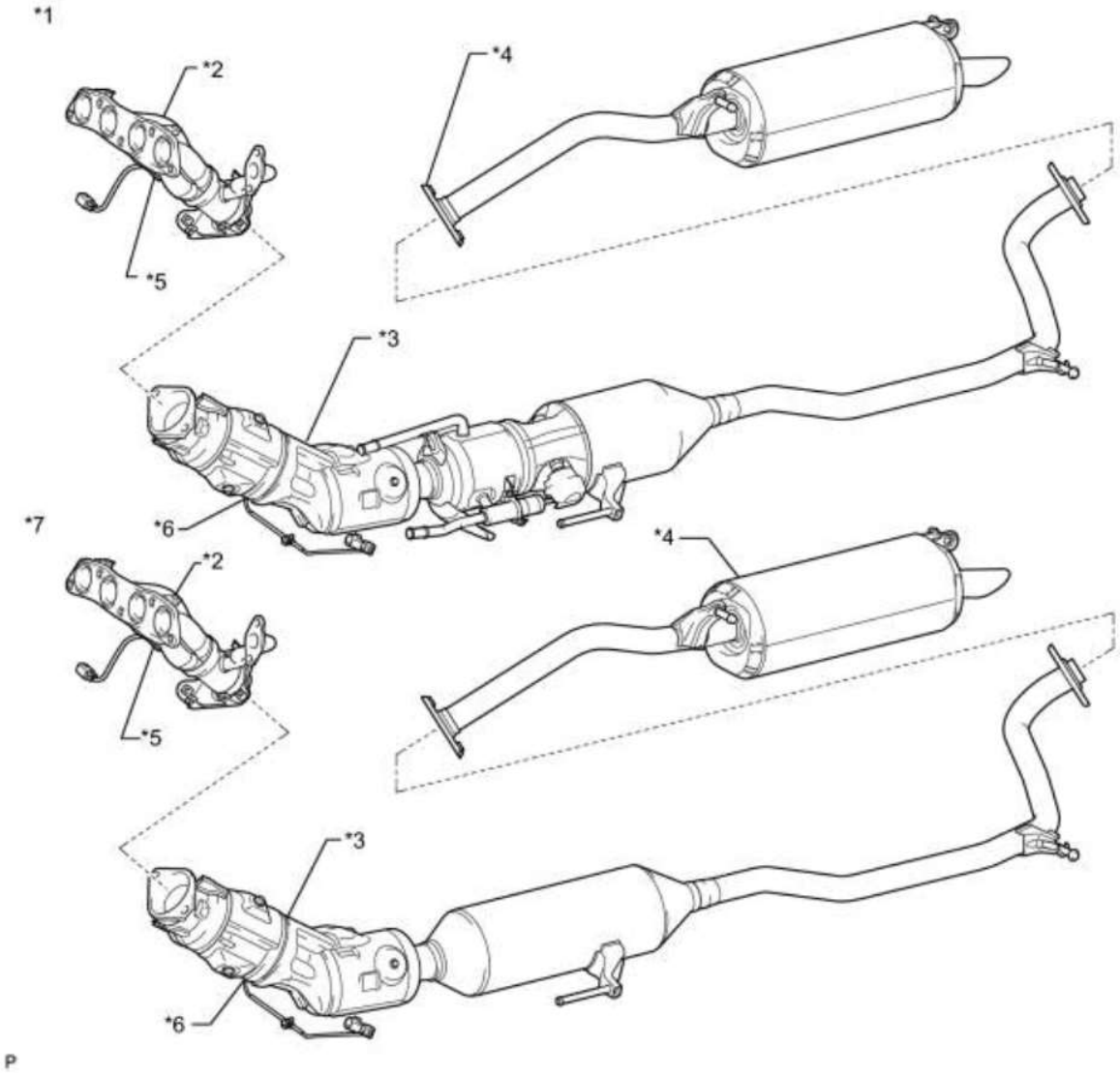
DTC No.	DTC Detection Condition	Trouble Area
P0420	Oxygen storage capacity value smaller than standard value under active air fuel ratio control (2 trip detection logic)	• Gas leaks from exhaust system • Air fuel ratio sensor (sensor 1) • Heated oxygen sensor (sensor 2) • Front exhaust pipe assembly (TWC: Front and rear catalyst) • EGR valve assembly

HINT:

- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.

CATALYST LOCATION

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Text in Illustration

*1	w/ Exhaust Heat Recirculation System	*2	Exhaust Manifold Sub-assembly
*3	Front Exhaust Pipe Assembly (TWC: Front and Rear Catalyst)	*4	Tail Exhaust Pipe Assembly
*5	Air Fuel Ratio Sensor (Sensor 1)	*6	Heated Oxygen Sensor (Sensor 2)
*7	w/o Exhaust Heat Recirculation System	-	-

MONITOR STRATEGY

Related DTCs	P0420: Catalyst Deterioration
Required Sensors/Components (Main)	Air fuel ratio sensor Heated oxygen sensor

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Required Sensors/Components (Related)	Intake air temperature sensor Mass air flow meter sub-assembly Crankshaft position sensor Engine coolant temperature sensor
Frequency of Operation	Once per driving cycle
Duration	About 30 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	P0010 (VVT Oil Control Valve Bank 1) P0011 (VVT System Bank 1 - Advance) P0012 (VVT System Bank 1 - Retard) P0016 (VVT System Bank 1 - Misalignment) P0031, P0032, P101D (Air Fuel Ratio Sensor Heater - Sensor 1) P0037, P0038, P102D (Heated Oxygen Sensor Heater - Sensor 2) P0102, P0103 (Mass Air Flow Meter) P0107, P0108 (Manifold Absolute Pressure) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0136, P0137, P0138, P0139 (Rear Oxygen sensor - Sensor 2) P0171, P0172 (Fuel System) P0301, P0302, P0303, P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0340, P0342, P0343 (Camshaft Position Sensor)

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	P0351, P0352, P0353, P0354 (Igniter) P0401 (EGR System (Closed)) P0607 (Heated Oxygen Sensor - Sensor 2) P2195, P2196, P2237, P2238, P2239, P2252, P2253, P2A00 (Air Fuel Ratio Sensor - Sensor 1)
Battery voltage	11 V or more
Intake air temperature	-10°C (14°F) or more
Engine coolant temperature	75°C (167°F) or more
Atmospheric pressure	76 kPa (570 mmHg) or more
Idling	OFF
Engine speed	Less than 4000 rpm
Air fuel ratio sensor	Activated
Fuel system status	Closed loop
Engine load	10 to 70%
All of the following conditions are met	Conditions 1, 2 and 3
1. Mass air flow rate	8 to 28 g/sec
2. Front catalyst temperature (estimated)	550 to 750°C (1022 to 1382°F)
3. Rear catalyst temperature (estimated)	450 to 700°C (842 to 1292°F)
Air fuel ratio sensor monitor	Completed
Rear Heated oxygen sensor monitor	Completed

TYPICAL MALFUNCTION THRESHOLDS

Oxygen storage capacity of catalyst	Less than 0.07 g

MONITOR RESULT

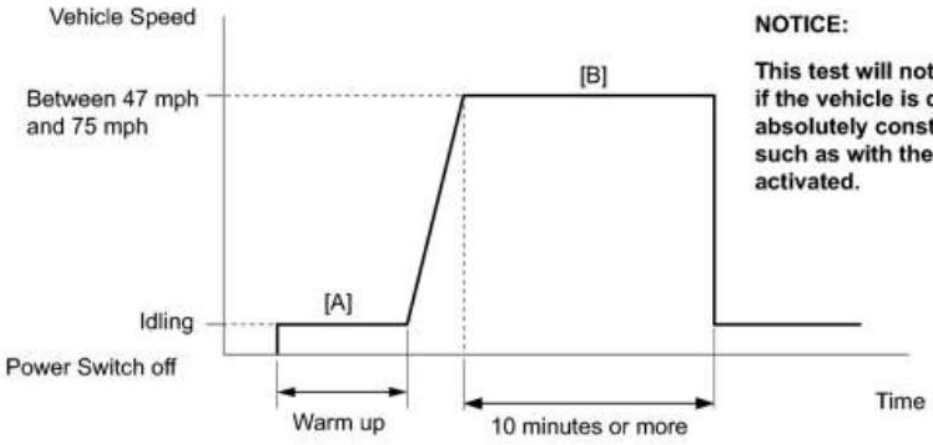
Refer to Checking Monitor Status INFO.

CONFIRMATION DRIVING PATTERN

HINT:

Performing this confirmation pattern will activate the catalyst monitor. This is very useful for verifying the completion of a repair.

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(HINT: Even if vehicle stops during driving pattern, test can be resumed)

P

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG).
3. Turn the Techstream on.
4. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
5. Turn the power switch off.
6. Turn the power switch on (IG) and turn the Techstream on.
7. Enter the following menus: Powertrain / Engine and ECT / Monitor.
8. Check that Catalyst Efficiency / Status2 is Incomplete.
9. Put the engine in inspection mode INFO.
10. Start the engine and warm it up (until the engine coolant temperature is 75°C (167°F) or higher) [A].
11. Drive the vehicle at between 47 and 75 mph (75 and 120 km/h) for at least 10 minutes or more [B].
12. Those items will change to Complete after completing the driving pattern.
13. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
14. Check if any DTCs (pending DTCs) are set.

HINT:

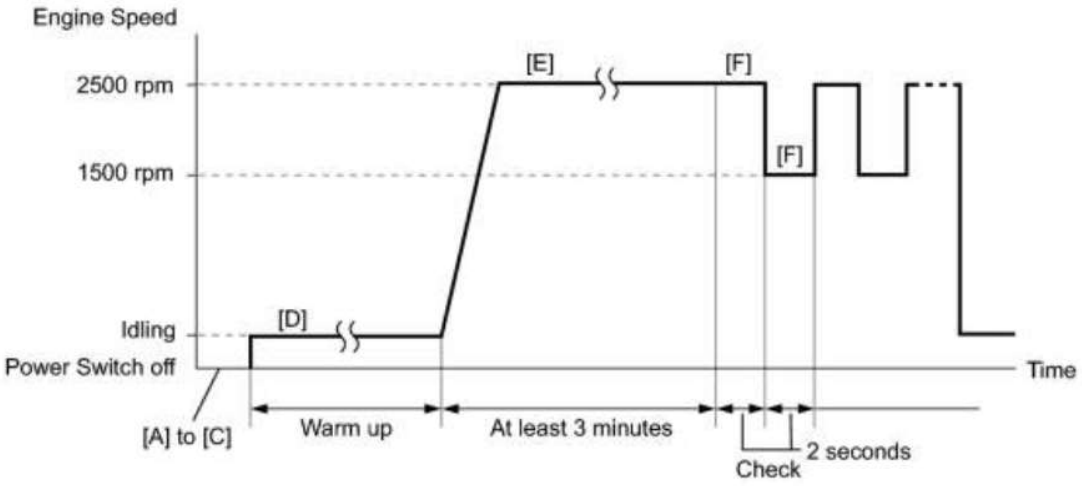
If Catalyst does not change to Complete, and no pending DTCs are stored, extend the driving time.

CONDITIONING FOR SENSOR TESTING

HINT:

Perform the operation with the engine speeds and time durations described below prior to checking the waveforms of the air fuel ratio sensor and heated oxygen sensor. This is in order to activate the sensors sufficiently to obtain the appropriate inspection results.

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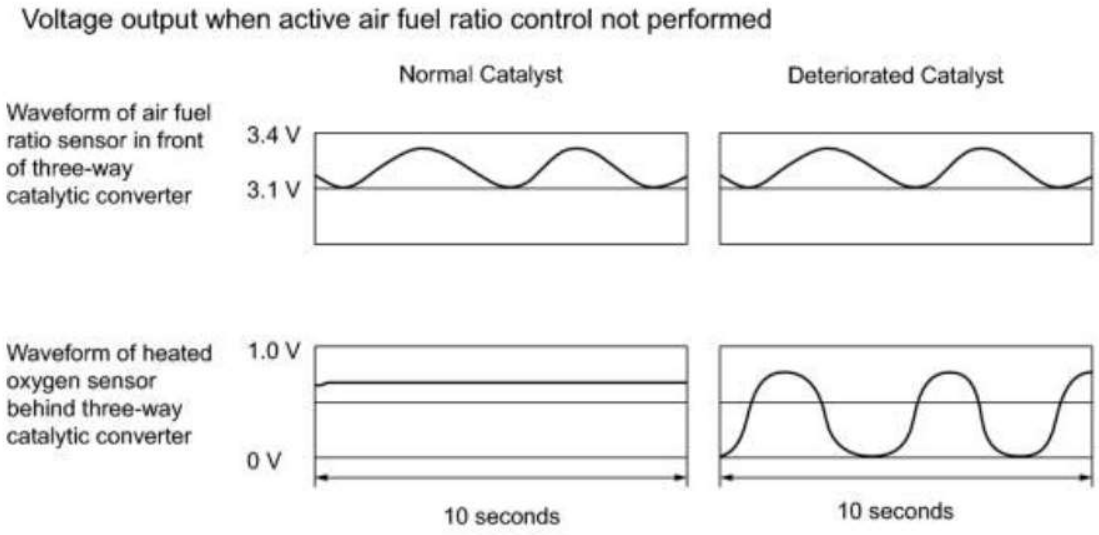
P

- (a) Connect the Techstream to the DLC3 [A].
- (b) Turn the power switch on (IG) and turn the Techstream on [B].
- (c) Put the engine in inspection mode INFO [C].
- (d) Start the engine and warm it up with all the accessories switched off until the engine coolant temperature stabilizes [D].
- (e) Run the engine at an engine speed of between 2500 rpm for at least 3 minutes [E].
- (f) While running the engine at 2500 rpm for 2 seconds and 1500 rpm for 2 seconds, check the waveforms of the air fuel ratio and heated oxygen sensors using the Techstream [F].

HINT:

- If either of the voltage outputs of the air fuel ratio or heated oxygen sensor does not fluctuate, or there is noise in the waveform of either sensor, the sensor may be malfunctioning.
- If the voltage outputs of both the sensors remain lean or rich, the air fuel ratio may be extremely lean or rich. In such cases, perform the Active Test operation by entering the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F sensor.
- If the three-way catalytic converter has deteriorated, the heated oxygen sensor (located behind the three-way catalytic converter) voltage output fluctuates up and down frequently, even under normal driving conditions (active air fuel ratio control is not performed).

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Y

INSPECTION PROCEDURE

1. AIR FUEL RATIO CONTROL

HINT:

Malfunctioning areas can be identified by performing the Control the Injection Volume for A/F Sensor function provided in the Active Test. The Control the Injection Volume for A/F Sensor function can help to determine whether the air fuel ratio sensor, heated oxygen sensor and other potential trouble areas are malfunctioning.

The following instructions describe how to conduct the Control the Injection Volume for A/F Sensor operation using the Techstream.

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG) and turn the Techstream on.

(c) Put the engine in inspection mode INFO.

(d) Start the engine.

(e) Warm up the engine at an engine speed of 2500 rpm for approximately 90 seconds.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor.

(g) Perform the Active Test operation with the engine in an idling condition (press the RIGHT or LEFT button to change the fuel injection volume).

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(h) Monitor the voltage outputs of the air fuel ratio and heated oxygen sensors (AFS Voltage B1S1 and O2S B1S2) displayed on the Techstream.

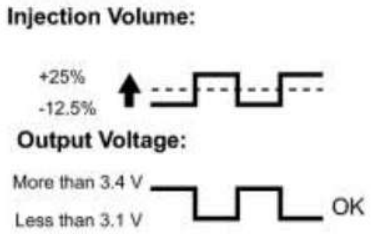
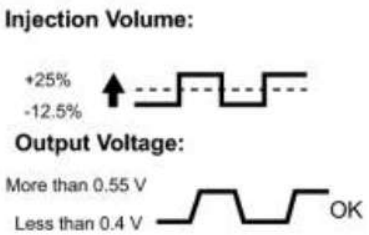
HINT:

- The Control the Injection Volume for A/F Sensor operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

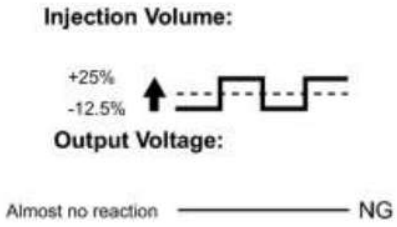
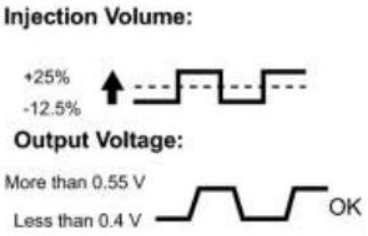
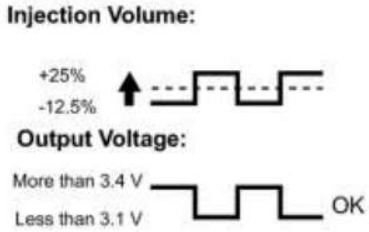
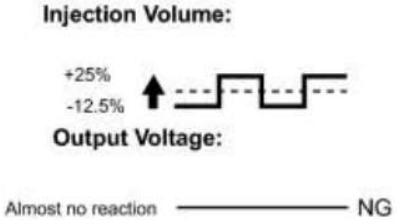
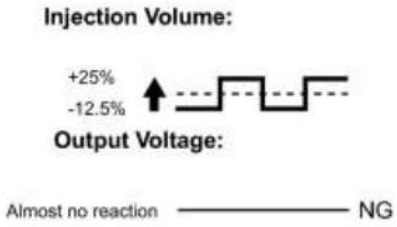
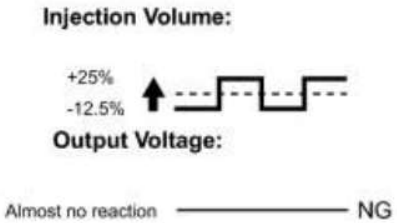
Techstream Display (Sensor)	Injection Volume	Status	Voltage
AFS Voltage B1S1 (Air fuel ratio)	+25%	Rich	Less than 3.1 V
AFS Voltage B1S1 (Air fuel ratio)	-12.5%	Lean	More than 3.4 V
O2S B1S2 (Heated oxygen)	+25%	Rich	More than 0.55 V
O2S B1S2 (Heated oxygen)	-12.5%	Lean	Less than 0.4 V

NOTICE:

The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

Case	Air Fuel Ratio Sensor (Sensor 1) Output Voltage	Heated Oxygen Sensor (Sensor 2) Output Voltage	Main Suspected Trouble Area
1			-
2			• Air fuel ratio sensor • Air fuel ratio sensor heater • Air fuel ratio sensor circuit

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Case	Air Fuel Ratio Sensor (Sensor 1) Output Voltage	Heated Oxygen Sensor (Sensor 2) Output Voltage	Main Suspected Trouble Area
			
3			• Heated oxygen sensor • Heated oxygen sensor heater • Heated oxygen sensor circuit • Exhaust gas leaks
4			• Fuel pressure • Exhaust gas leaks (Air fuel ratio extremely lean or rich)

- Following the Control the Injection Volume for A/F Sensor procedure enables technicians to check and graph the voltage outputs of both the air fuel ratio and heated oxygen sensors.
- To display the graph, enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor / A/F Control System / AFS Voltage B1S1 and O2S B1S2.

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0420)

(a) Connect the Techstream to the DLC3.

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(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result:

Result	Proceed to
DTC P0420 is output	A
DTC P0420 and other DTCs are output	B

HINT:

If any DTCs other than P0420 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	PERFORM ACTIVE TEST USING TECHSTREAM (AIR FUEL RATIO CONTROL)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG) and turn the Techstream on.

(c) Put the engine in inspection mode INFO.

(d) Start the engine and warm it up.

(e) Run the engine at an engine speed of 2500 rpm for approximately 90 seconds.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F sensor.

(g) Perform the Active Test operation with the engine in an idling condition (press the RIGHT or LEFT button to change the fuel injection volume).

(h) Monitor the voltage outputs of the air fuel ratio sensor and heated oxygen sensor (AFS Voltage B1S1 and O2S B1S2) displayed on the Techstream.

HINT:

- The Control the Injection Volume for A/F sensor operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

  Standard:

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Techstream Display (Sensor)	Injection Volume	Status	Voltage
AFS Voltage B1S1 (Air fuel ratio)	+25%	Rich	Less than 3.1 V
	-12.5%	Lean	More than 3.4 V
O2S B1S2 (Heated oxygen)	+25%	Rich	More than 0.55 V
	-12.5%	Lean	Less than 0.4 V

Result:

Status AFS Voltage B1S1	Status O2S B1S2	Air Fuel Ratio Condition and Air Fuel Ratio and Heated Oxygen Sensors Condition	Misfire	Main Suspected Trouble Area	Proceed to
Lean/Rich	Lean/Rich	Normal	-	○ Three-way catalytic converter ○ Gas leaks from exhaust system	A
Lean	Lean/Rich	Air fuel ratio sensor malfunction	-	○ Air fuel ratio sensor	B
Rich	Lean/Rich	Air fuel ratio sensor malfunction	-	○ Air fuel ratio sensor	
Lean/Rich	Lean	Heated oxygen sensor malfunction	-	○ Heated oxygen sensor ○ Gas leaks from exhaust system	C
Lean/Rich	Rich	Heated oxygen sensor malfunction	-	○ Heated oxygen sensor ○ Gas leaks from exhaust system	
Lean	Lean	Actual air fuel ratio lean	May occur	○ Extremely rich or lean actual air fuel ratio ○ Gas leaks from exhaust system	D
Rich	Rich	Actual air fuel ratio rich	-	○ Extremely rich or lean actual air fuel ratio ○ Gas leaks from exhaust system	

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Lean: During Control the Injection Volume for A/F sensor, the air fuel ratio sensor output voltage (AFS Voltage) is consistently more than 3.4 V, and the heated oxygen sensor output voltage (O2S) is consistently less than 0.4 V.

Rich: During the AFS Voltage is consistently less than 3.1 V, and the O2S is consistently more than 0.55 V.

Lean/Rich: During Control the Injection Volume for A/F sensor of the Active Test, the output voltage of the heated oxygen sensor alternates correctly.

- The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

D ▶ INSPECT FOR EXHAUST GAS LEAK
C ▶ INSPECT FOR EXHAUST GAS LEAK
B ▶ REPLACE AIR FUEL RATIO SENSOR (SENSOR 1)
A
▼

3.	INSPECT FOR EXHAUST GAS LEAK

(a) Inspect for exhaust gas leaks from the exhaust manifold sub-assembly and exhaust pipes.

OK:

No gas leaks.

NG ▶ REPAIR OR REPLACE EXHAUST GAS LEAK POINT
OK
▼

4.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

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HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

Result:

Result	Proceed to
Outside of standard range	A
Within standard range	B

B ▶ REPLACE FRONT EXHAUST PIPE ASSEMBLY (TWC: FRONT AND REAR CATALYST)

A ▼

5.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

NG ▶ REPLACE EGR VALVE ASSEMBLY

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OK ▶ **REPLACE FRONT EXHAUST PIPE ASSEMBLY (TWC: FRONT AND REAR CATALYST)**

6.	INSPECT FOR EXHAUST GAS LEAK

(a) Inspect for exhaust gas leaks from the exhaust manifold sub-assembly and exhaust pipes.

OK:

No gas leaks.

NG ▶ REPAIR OR REPLACE EXHAUST GAS LEAK POINT

OK ▶ **REPLACE HEATED OXYGEN SENSOR (SENSOR 2)**

7.	INSPECT FOR EXHAUST GAS LEAK

(a) Inspect for exhaust gas leaks from the exhaust manifold sub-assembly and exhaust pipes.

OK:

No gas leaks.

NG ▶ REPAIR OR REPLACE EXHAUST GAS LEAK POINT

OK ▼

8.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

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OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

Result:

Result	Proceed to
Outside of standard range	A
Within standard range	B

B ▶ CHECK ENGINE TO DETERMINE CAUSE OF EXTREMELY RICH OR LEAN ACTUAL AIR FUEL RATIO

A ▼

9.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

NG ▶ REPLACE EGR VALVE ASSEMBLY

OK ▶ **CHECK ENGINE TO DETERMINE CAUSE OF EXTREMELY RICH OR LEAN ACTUAL AIR FUEL RATIO**

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DTC	P043E	Evaporative Emission System Reference Orifice Clog Up
DTC	P043F	Evaporative Emission System Reference Orifice High Flow
DTC	P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low
DTC	P2402	Evaporative Emission System Leak Detection Pump Control Circuit High
DTC	P2419	Evaporative Emission System Switching Valve Control Circuit Low

DTC SUMMARY

DTC No.	Monitoring Item	Malfunction Detection Condition	Trouble Area	Detection Timing	Detection Logic
P043E	0.02 inch orifice clogged	P043E, P043F, P2401, P2402, P2419 are present when one of the following conditions is met during key-off EVAP monitor • Reference orifice clogged • Reference orifice high-flow • Leak detection pump off malfunction • Leak detection pump on malfunction • Vent valve on (closed) malfunction	• Canister pump module • Connector/wire harness (canister pump module - ECM) • ECM	While power switch off	2 trip
P043F	0.02 inch orifice high-flow				
P2401	Leak detection pump stuck off				
P2402	Leak detection pump stuck on				
P2419	Vent valve stuck open (vent)				

HINT:

The 0.02 inch orifice is located inside the canister pump module.

DESCRIPTION

The circuit description can be found in the EVAP (Evaporative Emission) System INFO.

INSPECTION PROCEDURE

Refer to the EVAP System INFO.

MONITOR DESCRIPTION

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5 hours*1 after the power switch is turned off, the leak detection pump creates negative pressure (vacuum) in the EVAP (Evaporative Emission) system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.

HINT:

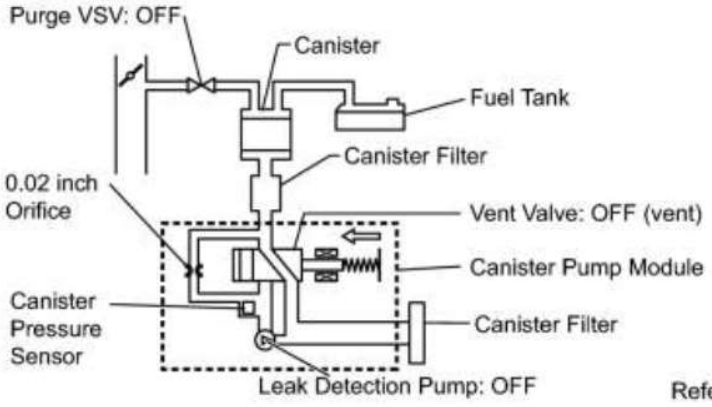
*1: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the power switch is turned off, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the power switch is turned off, the monitor check starts 2.5 hours later.

Sequence	Operation	Description	Duration
-	ECM activation	Activated by soak timer, 5, 7 or 9.5 hours after power switch turned off.	-
A	Atmospheric pressure measurement	Vent valve is turned off (vent) and EVAP system pressure is measured by ECM in order to register atmospheric pressure. If pressure in EVAP system is not between 70 kPa and 112 kPa (525 mmHg and 840 mmHg), ECM cancels EVAP system monitor.	60 seconds
B	First 0.02 inch leak pressure measurement	In order to determine 0.02 inch leak pressure standard, leak detection pump creates negative pressure (vacuum) through 0.02 inch orifice and then ECM checks if leak detection pump and vent valve operate normally.	360 seconds
C	EVAP system pressure measurement	Vent valve is turned on (closed) to shut EVAP system. Negative pressure (vacuum) is created in EVAP system, and EVAP system pressure is then measured. Write down measured value as it will be used in leak check. If EVAP pressure does not stabilize within 15 minutes, ECM cancels EVAP system monitor.	15 minutes*2
D	Purge VSV monitor	Purge VSV is opened and then EVAP system pressure is measured by ECM. Large increase indicates normal.	10 seconds
E	Second 0.02 inch leak pressure measurement	After second 0.02 inch leak pressure measurement, leak check is performed by comparing first and second 0.02 inch leak pressure standards. If stabilized system pressure is higher than second 0.02 inch leak pressure standard, ECM determines that EVAP system is leaking.	60 seconds
F	Final check	Atmospheric pressure is measured and then monitoring result is recorded by ECM.	-

*2: If only a small amount of fuel is in the fuel tank, it takes longer for the EVAP pressure to stabilize.

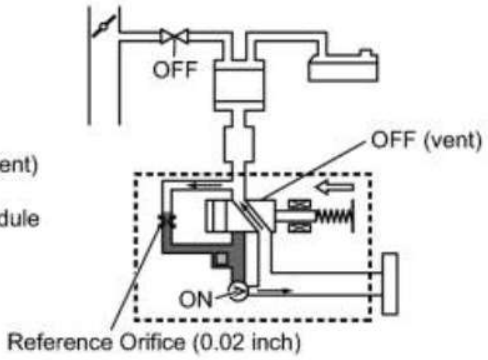
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Operation A: Atmospheric Pressure Measurement

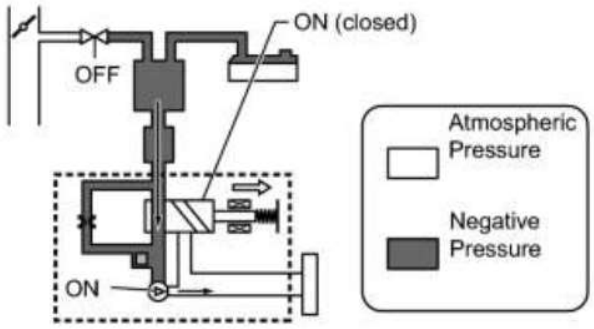


Operation B, E:

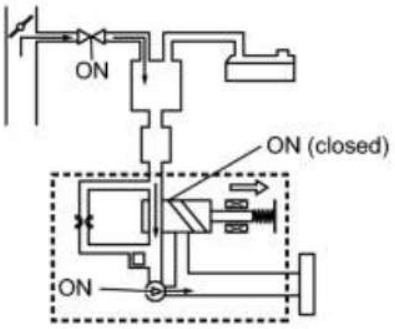
0.02 inch Leak Pressure Measurement



Operation C: EVAP System Pressure Measurement

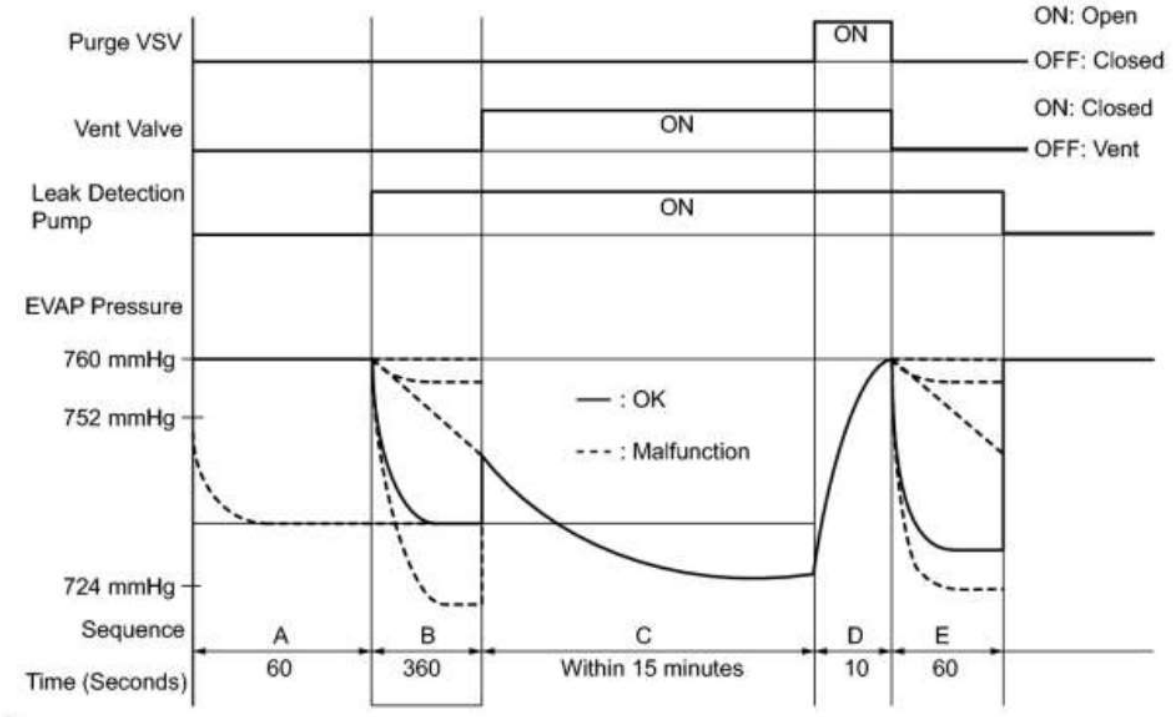


Operation D: Purge VSV Monitor



c

EVAP Pressure during EVAP key-off monitor



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The leak detection pump creates negative pressure through the reference orifice. When the system is normal, the EVAP pressure is in 724 to 752 mmHg* and saturated within a minute.

If not, the ECM interprets this as a malfunction. The ECM will illuminate the MIL and set DTC if this malfunction is detected in consecutive driving cycle.

*: Typical value

MONITOR STRATEGY

Related DTCs	P043E: 0.02 inch reference orifice low-flow (built-in canister pump module) P043F: 0.02 inch reference orifice high-flow (built-in canister pump module) P2401: Leak detection pump stuck off P2402: Leak detection pump stuck on P2419: Vent valve stuck open (vent)
Required Sensors / Components	Canister pump module
Frequency of Operation	Once per driving cycle
Duration	Within 2 minutes
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

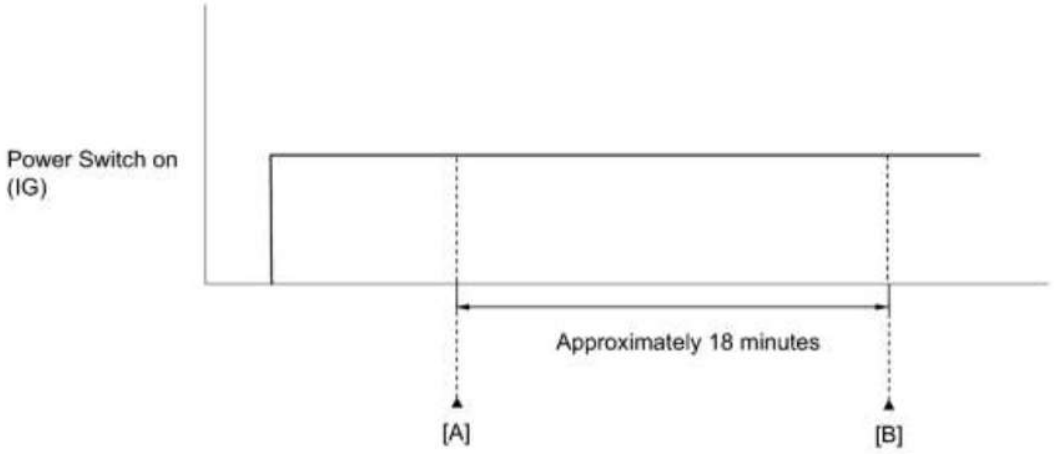
Monitor runs whenever following DTCs are not present	None
Atmospheric pressure	70 to 112 kPa (525 to 840 mmHg)
Battery voltage	10.5 V or more
Vehicle speed	Below 2.5 mph (4 km/h)
Power switch	OFF
Time after key off	5, 7 or 9.5 hours
Canister pressure sensor malfunction (P0452 and P0453)	Not detected
Purge VSV	Not operated by scan tool
Vent valve	Not operated by scan tool
Leak detection pump	Not operated by scan tool
Both of the following conditions are met before key off:	Conditions 1 and 2
1. Duration that vehicle has been driven	5 minutes or more
2. EVAP purge operation	Performed
Engine coolant temperature	4.4 to 35°C (40 to 95°F)
Intake air temperature	4.4 to 35°C (40 to 95°F)

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TYPICAL MALFUNCTION THRESHOLDS

One of the following conditions is met:	-
EVAP pressure just after reference pressure measurement start	More than -0.25 kPa (-1.875 mmHg)
Reference pressure	Less than -4.85 kPa (-36.384 mmHg)
Reference pressure	-1.057 kPa (-7.929 mmHg) or more
Reference pressure	Not saturated within 60 seconds
Difference between first reference pressure and second reference pressure	0.9 kPa (6.751 mmHg) or more

CONFIRMATION DRIVING PATTERN



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NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 18 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F).

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on.
6. Enter the following menus: Powertrain / Engine and ECT / Utility / Evaporative System Check / Automatic Mode [A].

7. After the Evaporative System Check is completed, check for All Readiness by entering the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
8. Read the Pending DTC [B].
9. If a pending DTC is output, the system is malfunctioning.

HINT:

If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All readiness.
11. Input the DTC: P043E, P043F, P2401, P2402 or P2419.
12. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform step [A] again.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

15. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

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MONITOR RESULT

Refer to Checking Monitor Status INFO.

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DTC	P0441	Evaporative Emission Control System Incorrect Purge Flow

DTC SUMMARY

DTC No.	Monitoring Item	Malfunction Detection Condition	Trouble Area	Detection Timing	Detection Logic
P0441	Purge VSV stuck open	Leak detection pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure is measured. 0.02 inch leak pressure standard is measured at start and end of leak check. If stabilized pressure is higher than [second 0.02 inch leak pressure standard x 0.2], ECM determines that purge VSV is stuck open.	• Purge VSV • Purge VSV circuit (between purge VSV and ECM) • Leakage from EVAP line (between purge VSV and intake manifold) • EVAP line clogged (between purge VSV and canister) • EGR valve assembly • ECM	While power switch off	2 trip
P0441	Purge VSV stuck closed	After EVAP leak check is performed, purge VSV is turned on (open), and atmospheric air is introduced into EVAP system. 0.02 inch leak pressure standard is measured at the start and end of leak check. If pressure does not return to near atmospheric pressure, ECM determines that purge valve is stuck closed.		While power switch off	2 trip
P0441	Purge flow	While engine running, the following conditions are successively met: • Negative pressure is not created in EVAP system when purge VSV is turned on (open) • EVAP system pressure change is less than 0.15 kPa (1.13 mmHg) when vent valve is turned on (closed) • Atmospheric pressure change before and after purge flow monitor is less than 0.1 kPa (0.75 mmHg)		While power switch off	2 trip

DESCRIPTION

The circuit description can be found in the EVAP (Evaporative Emission) System INFO.

INSPECTION PROCEDURE

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Refer to the EVAP System INFO.

MONITOR DESCRIPTION

The 2 monitors, key-off and purge flow, are used to detect malfunctions relating to DTC P0441. The key-off monitor is initiated by the ECM internal timer, known as the soak timer, 5 hours*1 after the power switch is turned off. The purge flow monitor runs while the engine is running.

1. KEY-OFF MONITOR

5 hours*1 after the power switch is turned off, the electric leak detection pump creates negative pressure (vacuum) in the EVAP (Evaporative Emission) system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.

HINT:

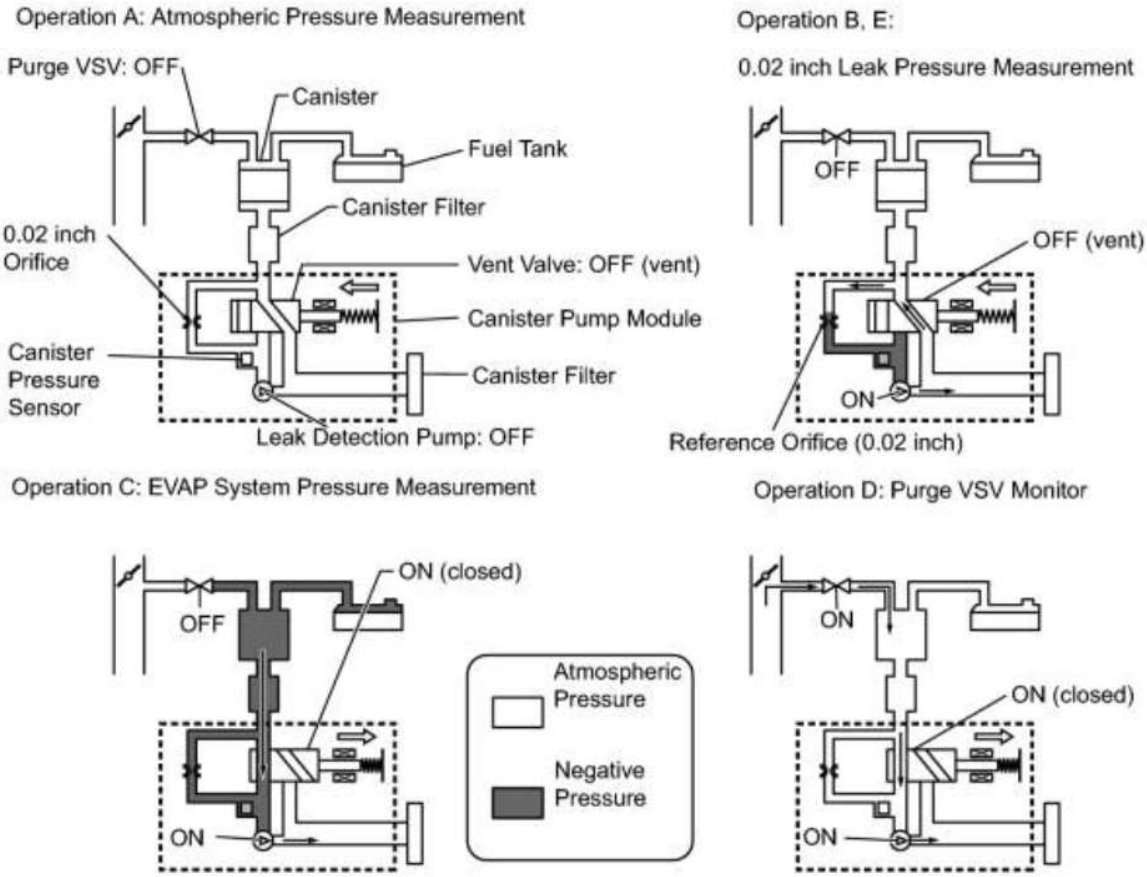
*1: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the power switch is turned off, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the power switch is turned off, the monitor check starts 2.5 hours later.

Sequence	Operation	Description	Duration
-	ECM activation	Activated by soak timer, 5, 7 or 9.5 hours after power switch turned off.	-
A	Atmospheric pressure measurement	Vent valve is turned off (vent) and EVAP system pressure is measured by ECM in order to register atmospheric pressure. If pressure in EVAP system is not between 70 kPa and 112 kPa (525 mmHg and 840 mmHg), ECM cancels EVAP system monitor.	60 seconds
B	First 0.02 inch leak pressure measurement	In order to determine 0.02 inch leak pressure standard, leak detection pump creates negative pressure (vacuum) through 0.02 inch orifice and then ECM checks if leak detection pump and vent valve operate normally.	360 seconds
C	EVAP system pressure measurement	Vent valve is turned on (closed) to shut EVAP system. Negative pressure (vacuum) is created in EVAP system, and EVAP system pressure is then measured. Write down measured value as it will be used in leak check. If EVAP pressure does not stabilize within 15 minutes, ECM cancels EVAP system monitor.	15 minutes*2
D	Purge VSV monitor	Purge VSV is opened and then EVAP system pressure is measured by ECM. A large increase indicates normal.	10 seconds
E	Second 0.02 inch leak pressure	After a second 0.02 inch leak pressure measurement, leak check is performed by comparing first and second 0.02 inch leak pressure	60 seconds

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Sequence	Operation	Description	Duration
	measurement	standards. If stabilized system pressure is higher than second 0.02 inch leak pressure standard, ECM determines that EVAP system leaking.	
F	Final check	Atmospheric pressure is measured and then monitor result is recorded by ECM.	-

*2: If only a small amount of fuel is in the fuel tank, it takes longer for the EVAP pressure to stabilize.



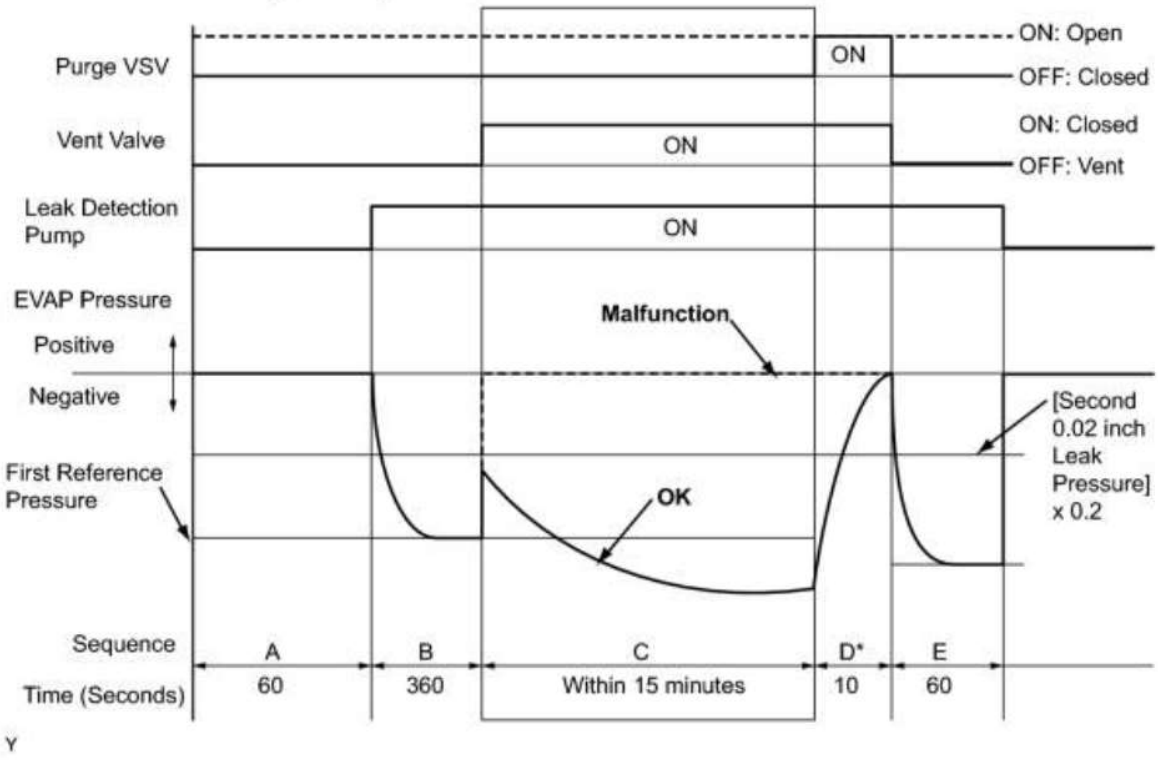
c

(a) Purge VSV stuck open

In operation C, the leak detection pump creates negative pressure (vacuum) in the EVAP (Evaporative Emission) system. The EVAP system pressure is then measured by the ECM using the canister pressure sensor. If the stabilized system pressure is higher than [second 0.02 inch leak pressure standard x 0.2], the ECM interprets this as the purge VSV being stuck open. The ECM illuminates the MIL and sets the DTC (2 trip detection logic).

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EVAP Pressure when Purge Stuck Open:



HINT:

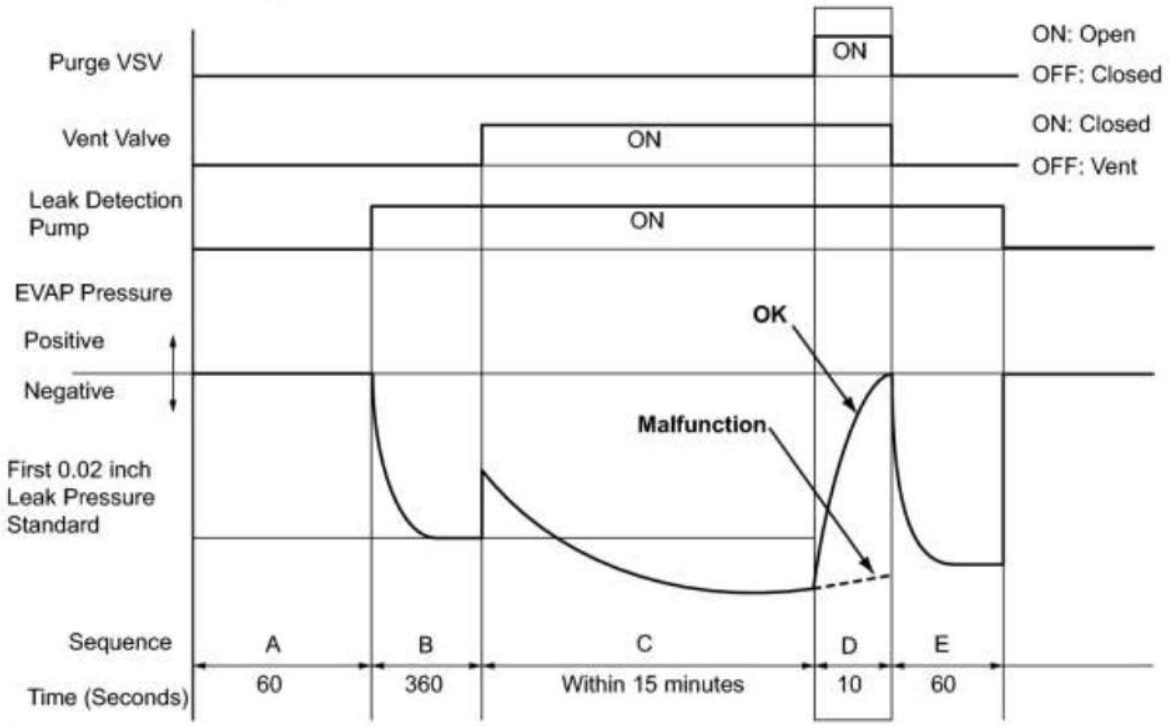
*: DTC P0441 may be stored if the hose between the purge VSV and canister is disconnected during evaporative emission control system operation.

(b) Purge VSV stuck closed

In operation D, the canister pressure sensor measures the EVAP (Evaporative Emission) system pressure. The pressure measurement for purge VSV monitor begins when the purge VSV is turned on (open) after the EVAP leak check. When the measured pressure indicates an increase of 0.3 kPa (2.25 mmHg) or more, the purge VSV is functioning normally. If the pressure does not increase, the ECM interprets this as the purge VSV being stuck closed. The ECM illuminates the MIL and sets the DTC (2 trip detection logic).

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EVAP Pressure when Purge VSV Stuck Closed:

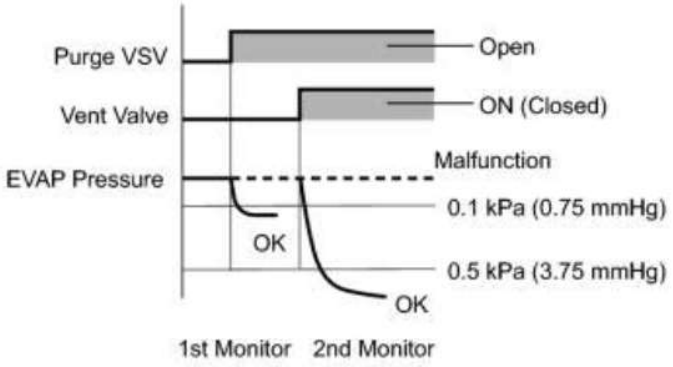


Y

2. PURGE FLOW MONITOR

The purge flow monitor consists of the 2 step monitors. The 1st monitor is conducted every time and the 2nd monitor is activated if necessary.

EVAP Pressure During Purge Flow Monitor:



Y

- The 1st monitor

  While the engine is running and the purge VSV is on (open), the ECM monitors the purge flow by measuring the EVAP pressure change. If negative pressure is not created, the ECM begins the 2nd monitor.

- The 2nd monitor

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The vent valve is turned on (closed) and the EVAP pressure is then measured. If the variation in the pressure is less than 0.5 kPa (3.75 mmHg), the ECM interprets this as the purge VSV being stuck closed, and illuminates the MIL and sets DTC P0441 (2 trip detection logic).

Atmospheric pressure check:

In order to ensure reliable malfunction detection, the variation between the atmospheric pressures, before and after conduction of the purge flow monitor, is measured by the ECM.

MONITOR STRATEGY

Related DTCs	P0441: Purge VSV stuck open P0441: Purge VSV stuck clised P0441: Purge flow
Required Sensors/Components	Purge VSV Canister pump module
Frequency of Operation	Once per driving cycle
Duration	Within 10 minutes: Purge flow Within 15 minutes: Purge VSV stuck open, Purge VSV stuck closed
MIL operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not present	None

Key-off Monitor

Atmospheric pressure	70 to 112 kPa (525 to 840 mmHg)
Battery voltage	10.5 V or more
Vehicle speed	Below 2.5 mph (4 km/h)
Power switch	OFF
Time after key off	5, 7 or 9.5 hours
Canister pressure sensor malfunction (P0452 and P0453)	Not detected
Purge VSV	Not operated by scan tool
Vent valve	Not operated by scan tool
Leak detection pump	Not operated by scan tool
Both of the following conditions are met before key off:	Conditions 1 and 2

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1. Duration that vehicle has been driven	5 minutes or more
2. EVAP purge operation	Performed
Engine coolant temperature	4.4 to 35°C (40 to 95°F)
Intake air temperature	4.4 to 35°C (40 to 95°F)

Purge Flow Monitor

Engine	Running
Engine coolant temperature	4.4°C (40°F) or more
Intake air temperature	4.4°C (40°F) or more
Canister pressure sensor malfunction	Not detected
Purge VSV	Not operated by scan tool
EVAP system check	Not operated by scan tool
Atmospheric pressure	70 to 112 kPa (525 to 840 mmHg)
Battery voltage	10 V or more
Purge duty cycle	8 % or more

TYPICAL MALFUNCTION THRESHOLDS

Purge VSV Stuck Open

EVAP pressure when vacuum introduction is complete	Higher than reference pressure x 0.2

Purge VSV Stuck Closed

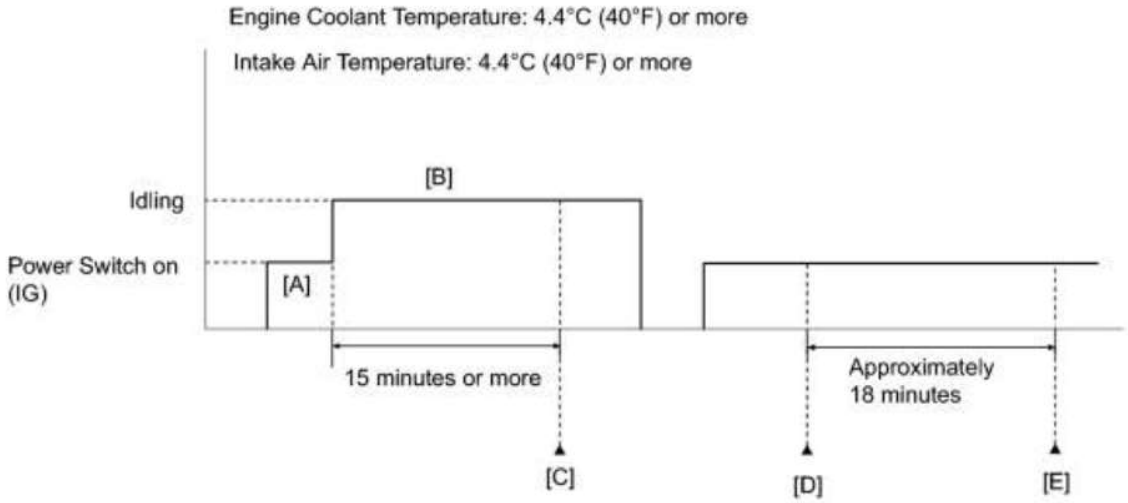
EVAP pressure change after purge VSV is open	Less than 0.3 kPa (2.25 mmHg)

Purge Flow

Both of the following conditions are met:	Conditions 1 and 2
1. EVAP pressure change when purge flow is started	Less than 0.1 kPa (0.75 mmHg)
2. EVAP pressure change during purge flow when EVAP pressure	Less than 0.5 kPa (3.75 mmHg)

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine and wait 15 minutes or more [B].
8. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes/ Pending.
9. Read the pending DTC [C].
10. If a pending DTC is output, the system is malfunctioning.

HINT:

If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine and ECT / Utility / All readiness.
12. Input the DTC: P0441.
13. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions

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Techstream Display	Description
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 18 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F).

14. Turn the power switch on (IG) and turn the Techstream on.
15. Clear the DTCs (even if no DTCs are stored, perform the clear the DTC operation) INFO.
16. Turn the power switch off.
17. Turn the power switch on (IG) and turn the Techstream on.
18. Enter the following menus: Powertrain / Engine and ECT / Utility / Evaporative System Check / Automatic Mode [D].
19. After the Evaporative System is completed, check for All Readiness by entering the following menus: Powertrain / Engine and ECT / Trouble Codes / pending.
20. Read the pending DTC [E].
21. If a pending DTC is output, the system is malfunctioning.

HINT:

If a pending DTC is not output, perform the following procedure.

22. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
23. Input the DTC: P0441.
24. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's

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Techstream Display	Description
	memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [B] and [D].

25. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
26. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

27. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

MONITOR RESULT

Refer to Checking Monitor Status INFO.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0441)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

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(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTC.

Result:

Result	Proceed to
DTC P0441 is output	A
DTC P0441 and other DTCs are output	B

B ▶ GO TO DTC CHART

A ▼

2.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps

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-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

Result:

Result	Proceed to
Outside of standard range	A
Within standard range	B

B ▶ GO TO EVAP SYSTEM

A ▼

3.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

NG ▶ REPLACE EGR VALVE ASSEMBLY
OK ▶ **GO TO EVAP SYSTEM**

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DTC	P0443	Evaporative Emission Control System Purge Control Valve Circuit

DESCRIPTION

HINT:

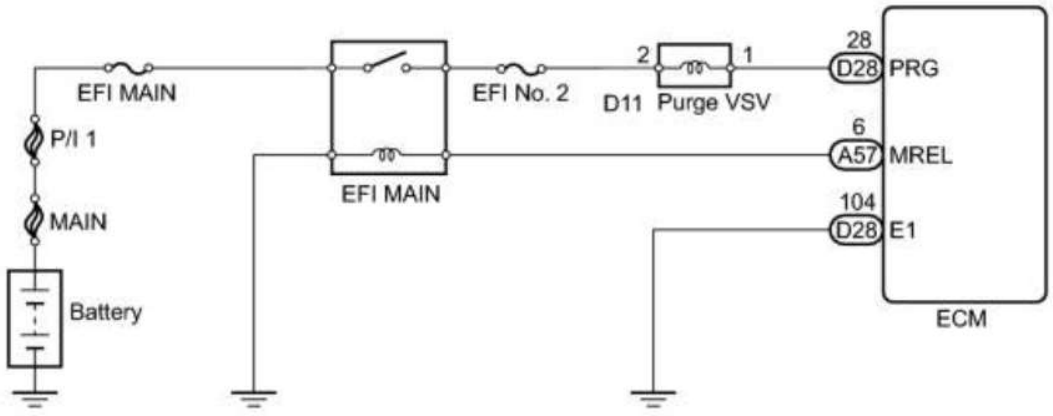
This DTC P0443 is applicable to Mexico models only.

To reduce hydrocarbons (HC) emissions, evaporated fuel from the fuel tank is routed through the canister to the intake manifold for combustion in the cylinders.

The ECM changes the duty signal to the purge VSV so that the intake quantity of hydrocarbons (HC) emissions is appropriate for the driving conditions (engine load, engine speed, vehicle speed, etc.) after the engine is warmed up.

DTC No.	DTC Detection Condition	Trouble Area
P0443	All of the following conditions (a) and (b) are met (1 trip detection logic) (a) The target control value and actual control value do not match for 10 seconds or more. (b) The target control value and actual control value is detected 80 times or more	• Open or short in purge VSV circuit • Purge VSV • ECM

WIRING DIAGRAM



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INSPECTION PROCEDURE

NOTICE:

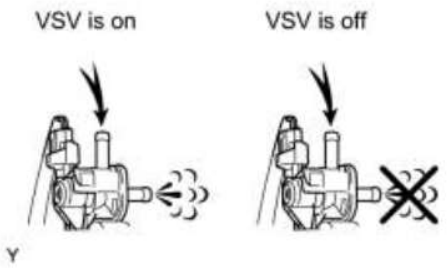
Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	PERFORM ACTIVE TEST USING TECHSTREAM (PURGE VSV)



(a) Connect the Techstream to the DLC3.

(b) Remove the canister side vacuum hose from the purge VSV.

(c) Turn the power switch on (IG) and turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Activate the VSV for Evap Control.

(g) Check if air is sucked into the port when operating the purge VSV using the Techstream.

OK:

Techstream Operation	Specified Condition
Purge VSV is on	Suction of air
Purge VSV is off	No suction of air

NG ▶ INSPECT PURGE VSV
OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

2.	INSPECT PURGE VSV

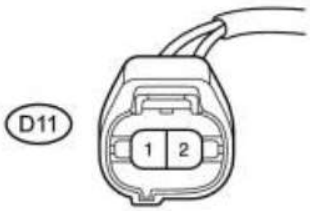
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(a) Inspect the purge VSV INFO.

NG ▶ REPLACE PURGE VSV
OK
▼

3.	INSPECT PURGE VSV (POWER SOURCE)

*1



(a) Disconnect the purge VSV connector.

N

(b) Turn the power switch on (IG).

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
D11-2 - Body ground	Power switch on (IG)	11 to 14 V

Text in Illustration

*1	Front view of wire harness connector (to Purge VSV)

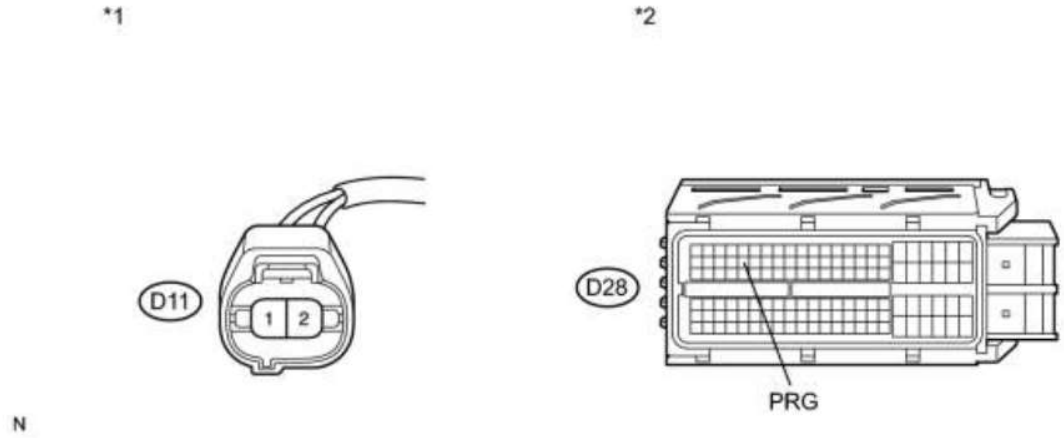
(d) Reconnect the purge VSV connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (PURGE VSV - EFI MAIN RELAY)
OK
▼

4.	CHECK HARNESS AND CONNECTOR (PURGE VSV - ECM)

(a) Disconnect the purge VSV connector.

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(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D11-1 (Purge VSV) - D28-28 (PRG)	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D11-1 (Purge VSV) or D28-28 (PRG) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Purge VSV)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the purge VSV connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (PURGE VSV - ECM)
OK ▶ **REPLACE ECM**

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DTC	P0451	Evaporative Emission Control System Pressure Sensor Range / Performance
DTC	P0452	Evaporative Emission Control System Pressure Sensor / Switch Low Input
DTC	P0453	Evaporative Emission Control System Pressure Sensor / Switch High Input

DTC SUMMARY

DTC No.	Monitoring Item	Malfunction Detection Condition	Trouble Area	Detection Timing	Detection Logic
P0451	Canister pressure sensor abnormal voltage fluctuation	Sensor output voltage fluctuates frequently in a certain time period.	• Canister pump module • Connector/wire harness (canister pump module - ECM) • ECM	• EVAP monitoring (power switch off) • Engine running	2 trip
P0452	Canister pressure sensor low input	EVAP pressure sensor less than 42.11 kPa (316 mmHg) for 0.5 seconds.		• Power switch on (IG) • EVAP monitoring (power switch off)	1 trip
P0453	Canister pressure sensor high input	EVAP pressure sensor more than 123.761 kPa (928.5 mmHg) for 0.5 seconds.		• Power switch on (IG) • EVAP monitoring (power switch off)	1 trip

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HINT:

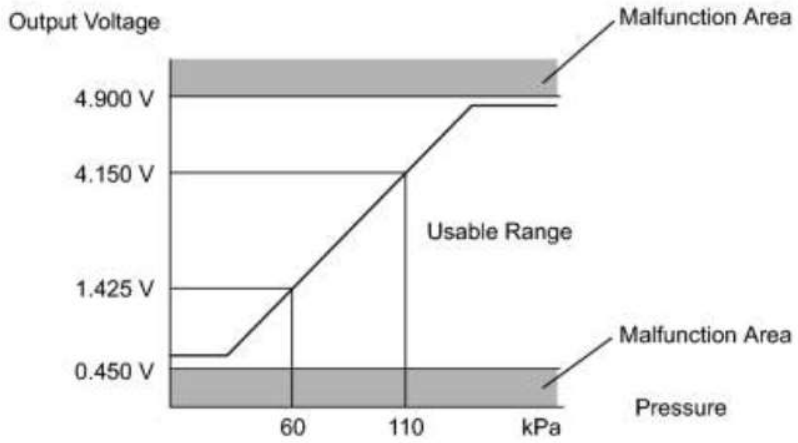
The canister pressure sensor is built into the canister pump module.

DESCRIPTION

The description can be found in the EVAP (Evaporative Emission) System INFO.

MONITOR DESCRIPTION

Canister Pressure Sensor Specification:



HINT:

Standard atmospheric pressure is 101.3 kPa

1. DTC P0451: Canister pressure sensor abnormal voltage fluctuation

   If the canister pressure sensor voltage output fluctuates rapidly for 10 seconds, the ECM stops the EVAP system monitor. The ECM interprets this as the canister pressure sensor voltage fluctuating, and stops the EVAP system monitor. The ECM then illuminates the MIL and sets the DTC.

   (Malfunction is detected by 2 trip detection logic.)

2. DTC P0452: Canister pressure sensor voltage low

   If the canister pressure sensor voltage output (pressure) is below 0.45 V (42.11 kPa (316 mmHg)), the ECM interprets this as an open or short circuit in the canister pressure sensor or its circuit, and stops the EVAP system monitor. The ECM then illuminates the MIL and sets the DTC (1 trip detection logic).

3. DTC P0453: Canister pressure sensor voltage high

   If the canister pressure sensor voltage output (pressure) is 4.9 V (123.761 kPa (928.5 mmHg) or more, the ECM interprets this as an open or short circuit in the canister pressure sensor or its circuit, and stops the EVAP system monitor. The ECM then illuminates the MIL and sets the DTC (1 trip detection logic).

MONITOR STRATEGY

Related DTCs	P0451: Evaporative emission control system canister pressure sensor noise P0452: Evaporative emission control system canister pressure sensor/switch low

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	input P0453: Evaporative emission control system canister pressure sensor/switch high input
Required Sensors / Components	Canister pump module
Frequency of Operation	Continuous
Duration	15 seconds: P0451 0.5 seconds: P0452, P0453
MIL Operation	Immediately: P0452, P0453 2 driving cycles: P0451
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not present	None

P0451

Atmospheric pressure	70 to 112 kPa (525 to 840 mmHg)
Battery voltage	10.5 V or more
Intake air temperature	4.4 to 50°C (40 to 122°F)
Canister pressure sensor malfunction (P0452, P0453)	Not detected
Either of the following conditions 1 or 2 is met:	-
1. Engine condition	Running
2. Time after key-off	5, 7 or 9.5 hours

P0452 and P0453

Power switch	On (IG)
Battery voltage	8 V or more

TYPICAL MALFUNCTION THRESHOLDS

P0451

Frequency that EVAP pressure change is 0.3 kPa (2.25 mmHg) or more	10 times or more in 10 seconds

P0452: Canister Pressure Sensor Low Voltage

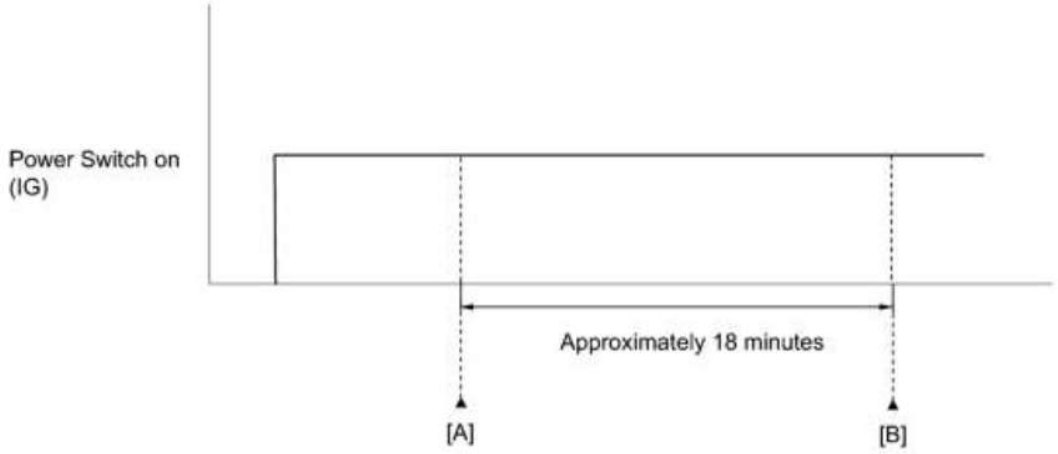
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EVAP pressure	Less than 42.11 kPa (316 mmHg)

P0453: Canister Pressure Sensor High Voltage

EVAP pressure	More than 123.761 kPa (928.5 mmHg)

CONFIRMATION DRIVING PATTERN



NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 18 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F).

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Enter the following menus: Powertrain / Engine and ECT / Data List / Intake Air.
4. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
5. Turn the power switch off and wait for 30 seconds.
6. Turn the power switch on (IG) and turn the Techstream on.
7. Enter the following menus: Powertrain / Engine and ECT / Utility / Evaporative System Check / Automatic Mode [A].
8. After the Evaporative System Check is completed, check for All Readiness by entering the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
9. Read the pending DTC [B].

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10. If a pending DTC is output, the system is malfunctioning.

    HINT:

    If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
12. Input the DTC: P0451, P0452 or P0453.
13. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

    HINT:

    - If the judgment result shows ABNORMAL, the system has a malfunction.
    - If the judgment result shows NORMAL, the system is normal.
    - If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [A] again.

14. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Check the judgment result.

    HINT:

    - If the judgment result shows ABNORMAL, the system has a malfunction.
    - If the judgment result shows NORMAL, the system is normal.

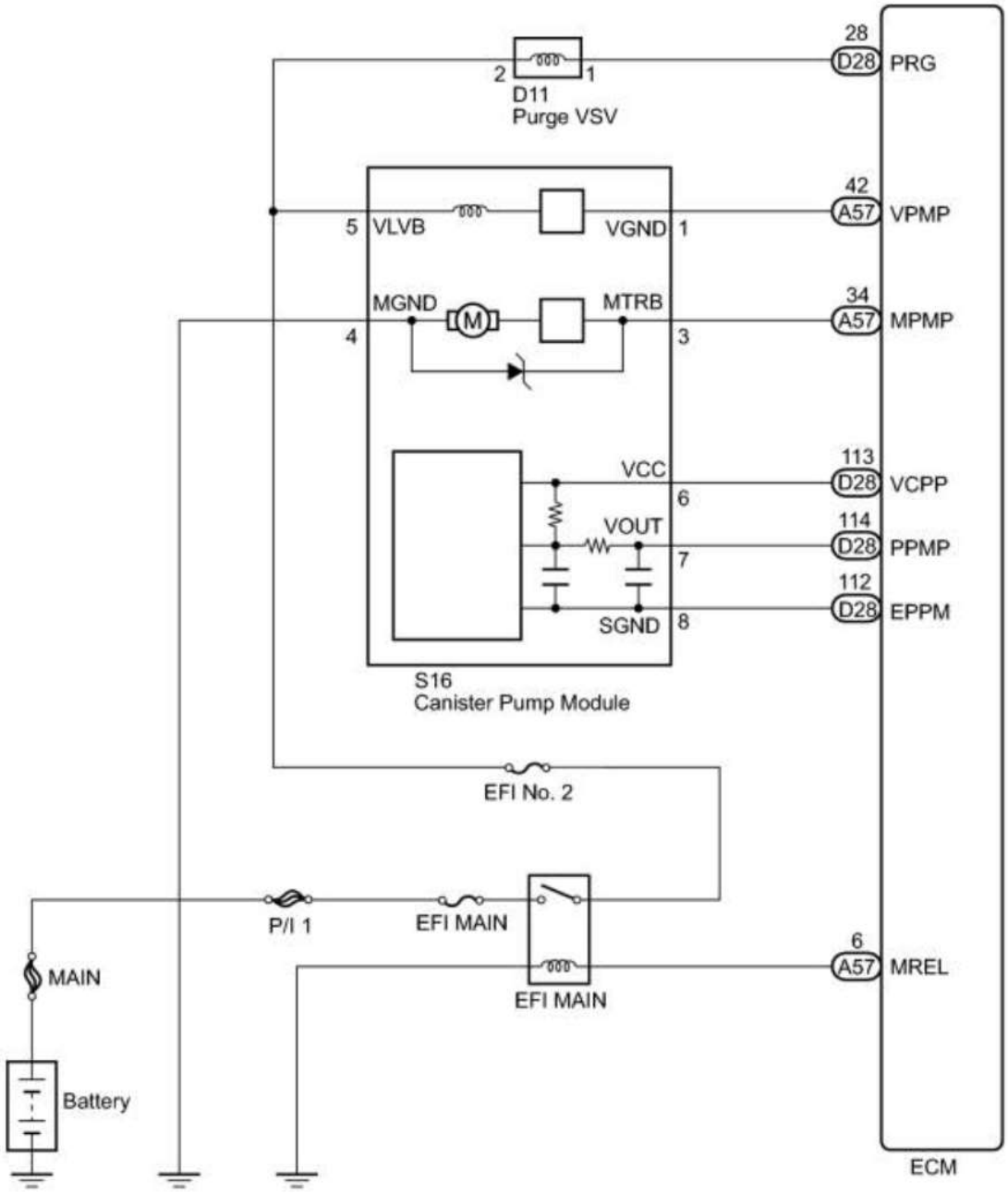
16. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

- When a vehicle is brought into the workshop, leave it as it is. Do not change the vehicle condition. For example, do not tighten the fuel cap.
- Do not disassemble the canister pump module.

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- The Techstream is required to conduct the following diagnostic troubleshooting procedure.

PROCEDURE

1.	CONFIRM DTC AND EVAP PRESSURE

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG) (do not start the engine).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

(f) Enter the following menus: Powertrain / Engine / Data List / Vapor Pressure Pump.

(g) Read the EVAP (Evaporative Emission) pressure displayed on the Techstream.

Result:

Display (DTC Output)	Test Result	Suspected Trouble Area	Proceed to
P0451	-	Canister pressure sensor	C
P0452	Less than 45 kPa (338 mmHg)	• Wire harness/connector (ECM - canister pressure sensor) • Canister pressure sensor • Short in ECM circuit	A
P0453	More than 120 kPa (900 mmHg)	• Wire harness/connector (ECM - canister pressure sensor) • Canister pressure sensor • Open in ECM circuit	B

C ▶ GO TO EVAP SYSTEM

B ▶ CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)

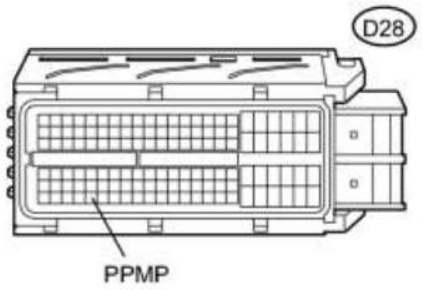
A ▼

2.	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)

(a) Turn the power switch off.

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*1



N

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Text in Illustration

*1	Front view of wire harness connector (to ECM)

Result:

Tester Connection	Condition	Specified Condition	Suspected Trouble Area	Proceed to
D28-114 (PPMP) - Body ground	Always	Below 10 Ω	• Wire harness/connector (ECM - canister pressure sensor) • Short in canister pressure sensor circuit	A
		10 kΩ or higher	• Wire harness/connector (ECM - canister pressure sensor) • Short in ECM circuit	B

(d) Reconnect the ECM connector.

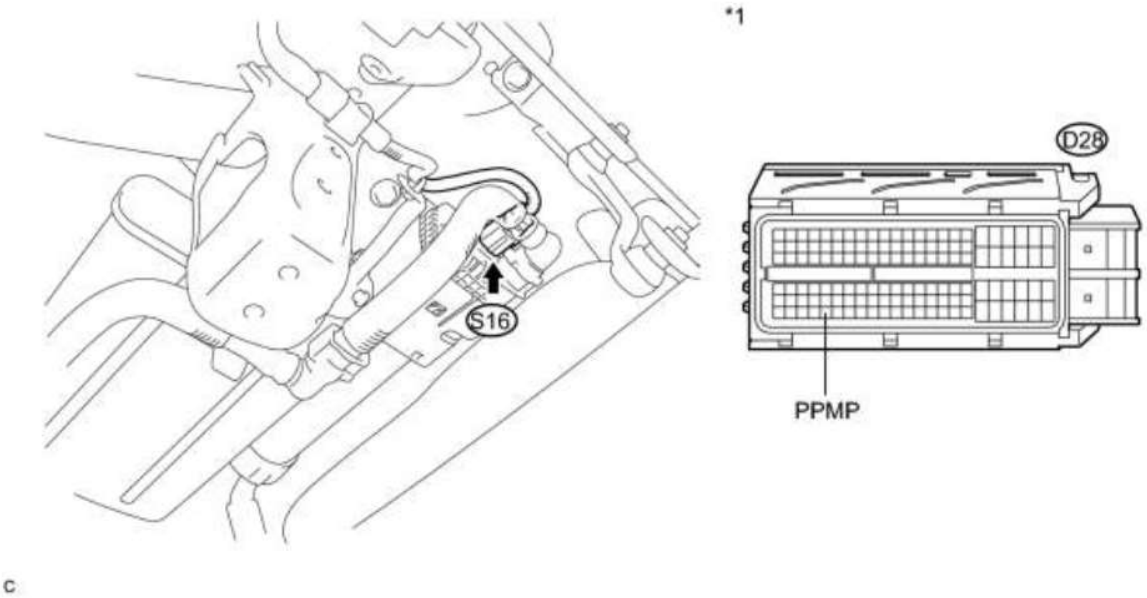
B ▶REPLACE ECM

A ▼

3.	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)

(a) Disconnect the canister pump module connector.

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C

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Text in Illustration

*1	Front view of wire harness connector (to ECM)

Result:

Tester Connection	Condition	Specified Condition	Suspected Trouble Area	Proceed to
D28-114 (PPMP) - Body ground	Always	10 kΩ or higher	Short in canister pressure sensor circuit	A
		Below 10 Ω	Short in wire harness/connector (ECM - Canister pressure sensor)	B

(d) Reconnect the canister pump module connector.

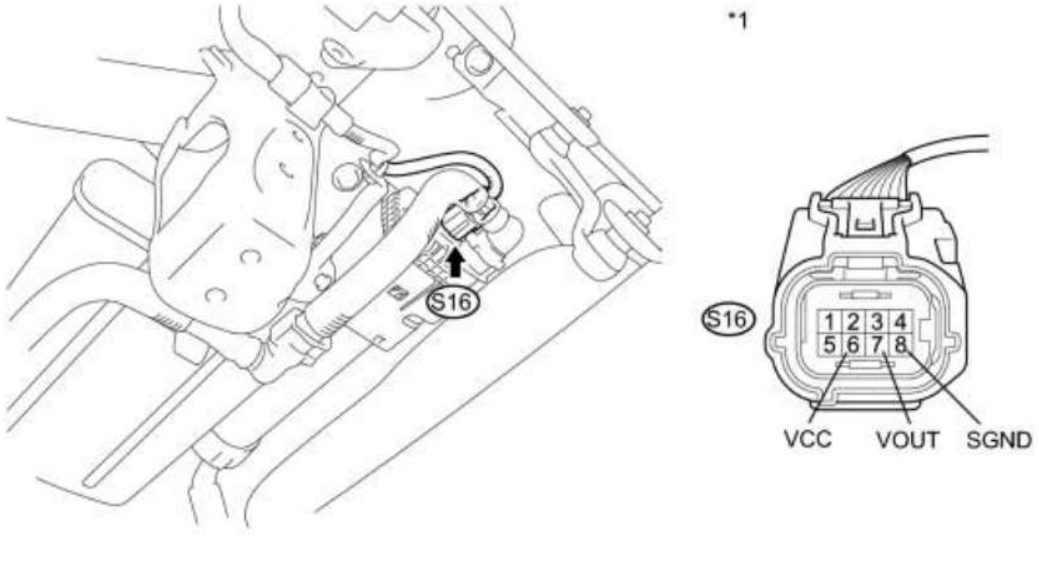
(e) Reconnect the ECM connector.

B ▶REPAIR OR REPLACE HARNESS OR CONNECTOR (CANISTER PUMP MODULE - ECM)
A ▶REPLACE CANISTER

4.	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)

(a) Disconnect the canister pump module connector.

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(b) Turn the power switch on (IG).

(c) Measure the voltage and resistance according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
S16-6 (VCC) - Body ground	Power switch on (IG)	4.5 to 5.5 V
S16-7 (VOUT) - Body ground	Power switch on (IG)	4.5 to 5.5 V

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
S16-8 (SGND) - Body ground	Always	Below 100 Ω

Text in Illustration

*1	Front view of wire harness connector (to Canister Pump Module)

Result:

Test Result	Suspected Trouble Area	Proceed to
Voltage and resistance within standard ranges	Open in canister pressure sensor circuit	A

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Test Result	Suspected Trouble Area	Proceed to
Voltage and resistance outside standard ranges	Open in wire harness/connector (ECM - canister pressure sensor)	B

(d) Reconnect the canister pump module connector.

B ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (CANISTER PUMP MODULE - ECM)

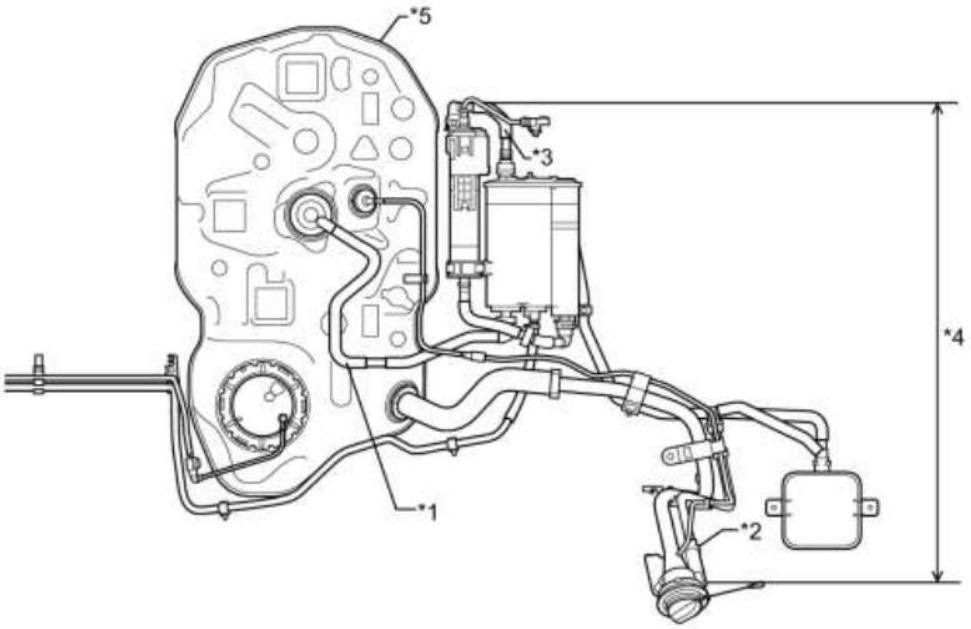
A ▼

5.	REPLACE CANISTER

(a) Replace the canister INFO.

NOTICE:

When replacing the canister, check the canister pump module interior and related pipes for water, fuel and other liquids. If liquids are present, check for disconnections and/or cracks in the following: 1) the pipe from the air inlet port to the canister pump module; 2) the canister filter; and 3) the fuel tank vent hose.



Text in Illustration

*1	Fuel Tank Vent Hose	*2	Air Inlet Port
*3	Vent Hose	*4	Inspection Area (Check for Disconnection and/or cracks)

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*5	Fuel Tank	-	-

NEXT CHECK WHETHER DTC OUTPUT RECURS (AFTER REPAIR)

6.	REPAIR OR REPLACE HARNESS OR CONNECTOR (CANISTER PUMP MODULE - ECM)

HINT:

If the exhaust tail pipe assembly has been removed, go to the next step before reinstalling it.

NEXT CHECK WHETHER DTC OUTPUT RECURS (AFTER REPAIR)

7.	REPLACE ECM

(a) Replace the ECM INFO.

NEXT

8.	CHECK WHETHER DTC OUTPUT RECURS (AFTER REPAIR)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Turn the power switch off and wait for 30 seconds.

(f) Turn the power switch on (IG) and turn the Techstream on.

(g) Start the engine and warm it up.

(h) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(i) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(j) Input the DTC: P0451, P0452 or P0453.

(k) Check the DTC judgment result.

HINT:

If DTC judgment result is NORMAL, the repair has been successfully completed.

NEXT **END**

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DTC	P0455	Evaporative Emission Control System Leak Detected (Gross Leak)
DTC	P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)

DTC SUMMARY

DTC No.	Monitoring Item	Malfunction Detection Condition	Trouble Area	Detection Timing	Detection Logic
P0455	EVAP gross leak	Leak detection pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure is measured. 0.02 inch leak pressure standard is measured at start and end of leak check. If stabilized pressure is higher than [second 0.02 inch leak pressure standard x 0.2], ECM determines that EVAP system has a large leak.	• Fuel cap (loose) • Leakage from EVAP line (canister - fuel tank) • Leakage from EVAP line (purge VSV - canister) • Leakage from canister pump module • Leakage from fuel tank • Leakage from canister	While power switch off	2 trip
P0456	EVAP small leak	Leak detection pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure is measured. 0.02 inch leak pressure standard measured at start and end of leak check. If stabilized pressure is higher than second 0.02 inch leak pressure standard, ECM determines that EVAP system has a small leak.		While power switch off	2 trip

DESCRIPTION

The circuit description can be found in the EVAP (Evaporative Emission) System INFO.

INSPECTION PROCEDURE

Refer to the EVAP System INFO.

MONITOR DESCRIPTION

5 hours*1 after the power switch is turned off, the leak detection pump creates negative pressure (vacuum) in the EVAP (Evaporative Emission) system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.

HINT:

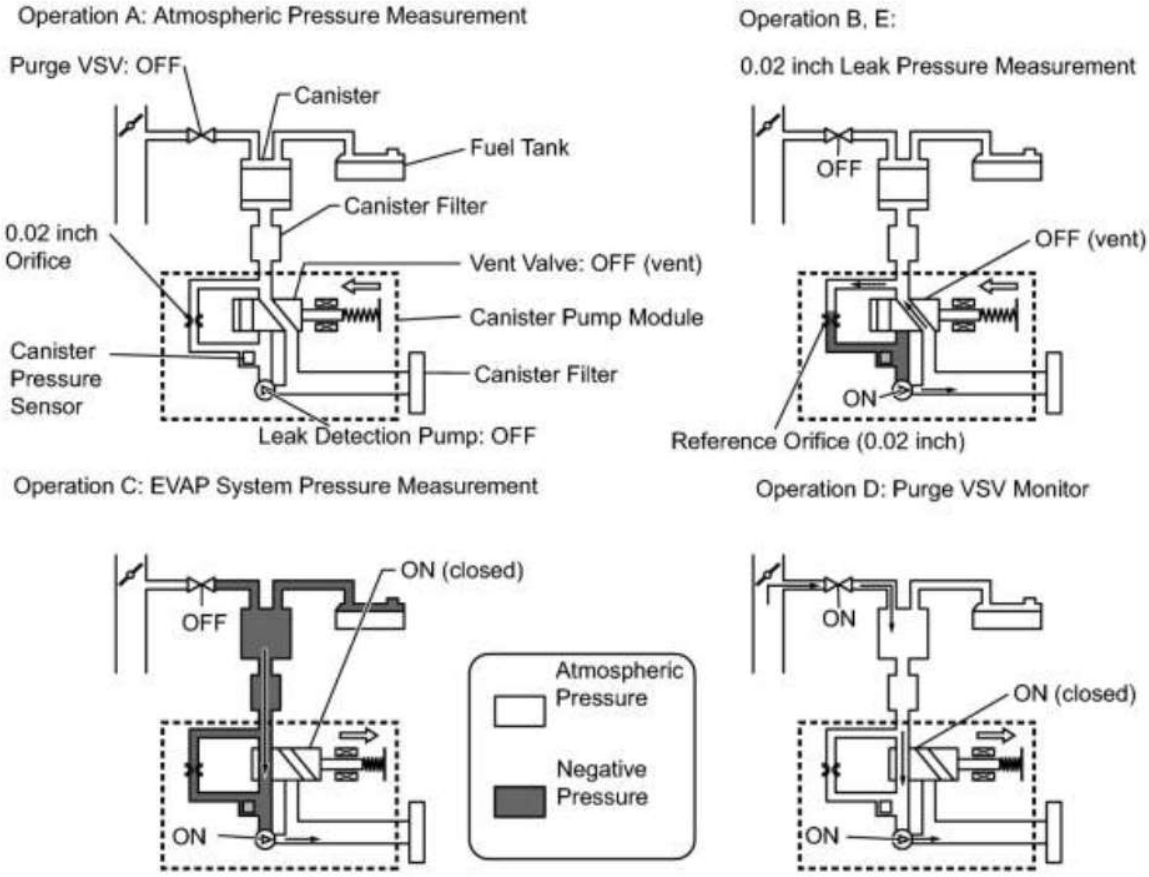
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*1: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the power switch is turned off, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the power switch is turned off, the monitor check starts 2.5 hours later.

Sequence	Operation	Description	Duration
-	ECM activation	Activated by soak timer, 5, 7 or 9.5 hours after power switch is turned off.	-
A	Atmospheric pressure measurement	Vent valve is turned off (vent) and EVAP system pressure is measured by ECM in order to register atmospheric pressure. If pressure in EVAP system is not between 70 kPa and 112 kPa (525 mmHg and 840 mmHg), ECM cancels EVAP system monitor.	60 seconds
B	First 0.02 inch leak pressure measurement	In order to determine 0.02 inch leak pressure standard, leak detection pump creates negative pressure (vacuum) through 0.02 inch orifice and then ECM checks if leak detection pump and vent valve operate normally.	360 seconds
C	EVAP system pressure measurement	Vent valve is turned on (closed) to shut EVAP system. Negative pressure (vacuum) is created in EVAP system, and EVAP system pressure is then measured. Write down measured value as it will be used in leak check. If EVAP pressure does not stabilize within 15 minutes, ECM cancels EVAP system monitor.	15 minutes*2
D	Purge VSV monitor	Purge VSV is opened and then EVAP system pressure is measured by ECM. Large increase indicates normal.	10 seconds
E	Second 0.02 inch leak pressure measurement	After second 0.02 inch leak pressure measurement, leak check is performed by comparing first and second 0.02 inch leak pressure standards. If stabilized system pressure is higher than second 0.02 inch leak pressure standard, ECM determines that EVAP system is leaking.	60 seconds
F	Final check	Atmospheric pressure is measured and then monitoring result is recorded by ECM.	-

*2: If only a small amount of fuel is in the fuel tank, it takes longer for the EVAP pressure to stabilize.

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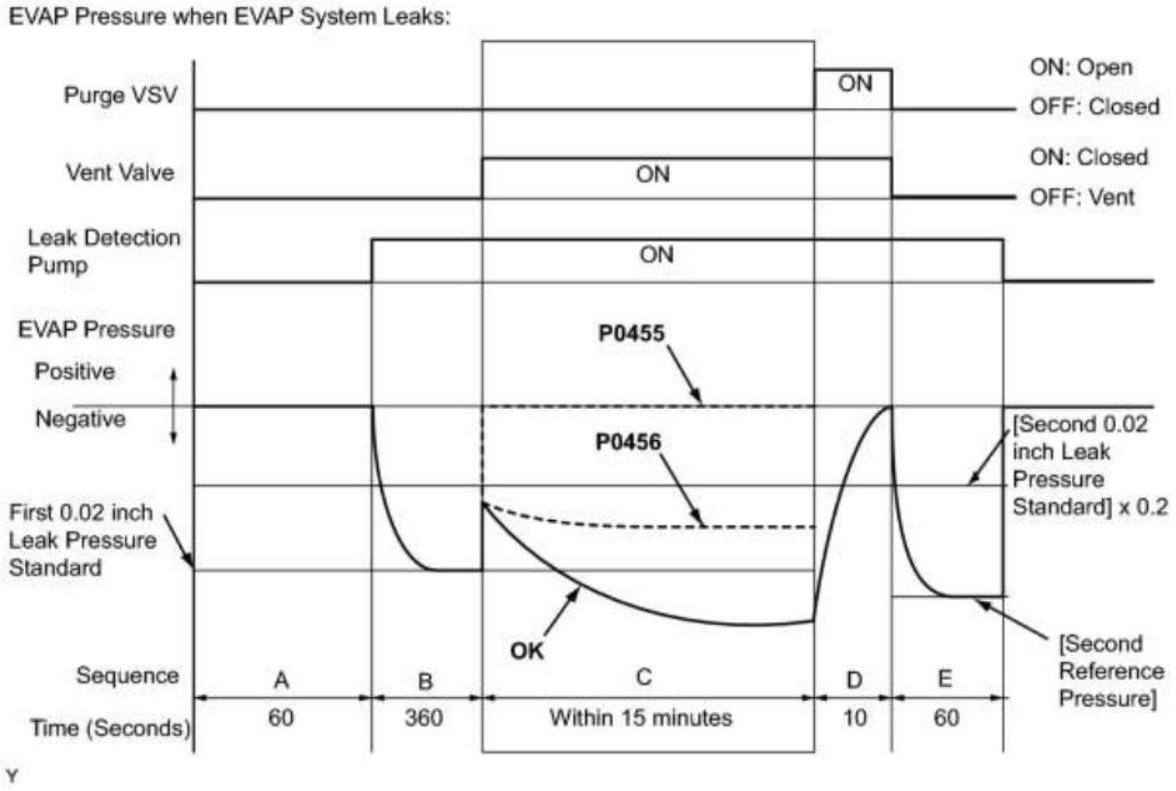
1. P0455: EVAP (Evaporative Emission) gross leak

   In operation C, the leak detection pump creates negative pressure (vacuum) in the EVAP system and the EVAP system pressure is measured. If the stabilized system pressure is higher than [second 0.02 inch leak pressure standard x 0.2] (near atmospheric pressure), the ECM determines that the EVAP system has a large leak, illuminates the MIL and sets the DTC (2 trip detection logic).

2. P0456: EVAP very small leak

   In operation C, the leak detection pump creates negative pressure (vacuum) in the EVAP system and the EVAP system pressure is measured. If the stabilized system pressure is higher than second 0.02 inch leak pressure standard, the ECM determines that the EVAP system has a small leak, illuminates the MIL and sets the DTC (2 trip detection logic).

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MONITOR STRATEGY

Related DTCs	P0455: Gross leak detected P0456: Very small leak (0.02 inch hole) detected
Required Sensors / Components	Purge VSV and canister pump module
Frequency of Operation	Once per driving cycle
Duration	Within 15 minutes
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

P0455, P0456

Monitor runs whenever following DTCs are not present	None
Atmospheric pressure	70 to 112 kPa (525 to 840 mmHg)
Battery voltage	10.5 V or more
Vehicle speed	Below 2.5 mph (4 km/h)
Power switch	OFF
Time after key off	5, 7 or 9.5 hours
Canister pressure sensor malfunction (P0452 and P0453)	Not detected

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Purge VSV	Not operated by scan tool
Vent valve	Not operated by scan tool
Leak detection pump	Not operated by scan tool
Both of the following conditions are met before key off:	Conditions 1 and 2
1. Duration that vehicle has been driven	5 minutes or more
2. EVAP purge operation	Performed
Engine coolant temperature	4.4 to 35°C (40 to 95°F)
Intake air temperature	4.4 to 35°C (40 to 95°F)

TYPICAL MALFUNCTION THRESHOLDS

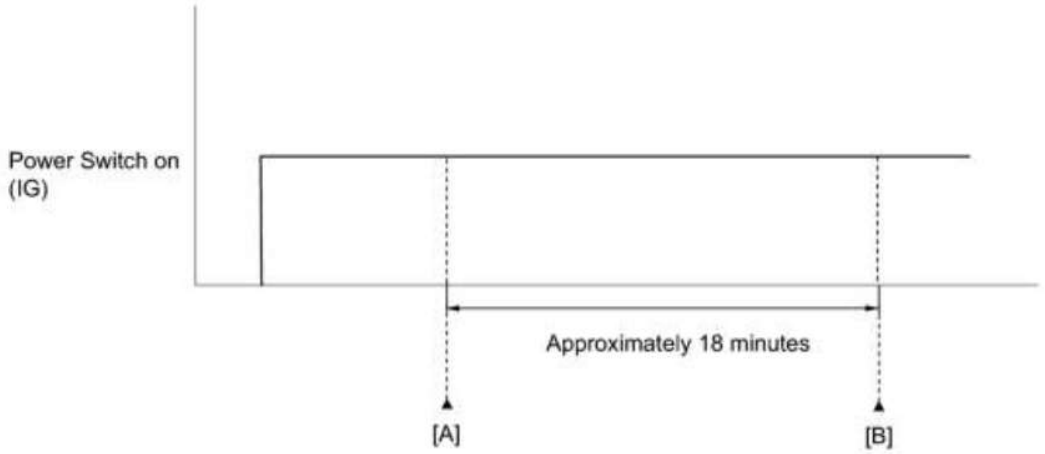
P0455: EVAP gross leak

EVAP pressure when vacuum introduction is complete	Higher than reference pressure x 0.2

P0456: EVAP 0.02 inch leak

EVAP pressure when vacuum introduction is complete	Between reference pressure and reference pressure x 0.2

CONFIRMATION DRIVING PATTERN



NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 18 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.

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- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F).

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on.
6. Enter the following menus: Powertrain / Engine and ECT / Utility / Evaporative System Check / Automatic Mode [A].
7. After the Evaporative System Check is completed, check for All Readiness by entering the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
8. Read the pending DTC [B].
9. If a pending DTC is output, the system is malfunctioning.

   HINT:

   If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P0455 or P0456.
12. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

   HINT:

   - If the judgment result shows ABNORMAL, the system has a malfunction.
   - If the judgment result shows NORMAL, the system is normal.
   - If the judgment result shows INCOMPLETE or UNKNOWN, perform step [A] again.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Check the judgment result.

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HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

15. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

MONITOR RESULT

Refer to Checking Monitor Status INFO.

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DTC	P0505	Idle Control System Malfunction

DESCRIPTION

The idle speed is controlled by the electronic throttle control system. The electronic throttle control system is comprised of: 1) the one valve type throttle body; 2) a throttle actuator, which operates the throttle valve; 3) a throttle position sensor, which detects the opening angle of the throttle valve; 4) an accelerator pedal position sensor, which detects the accelerator pedal position; and 5) the ECM, which controls the electronic throttle control system. Based on the target idle speed, the ECM controls the throttle actuator to provide the proper throttle valve opening angle.

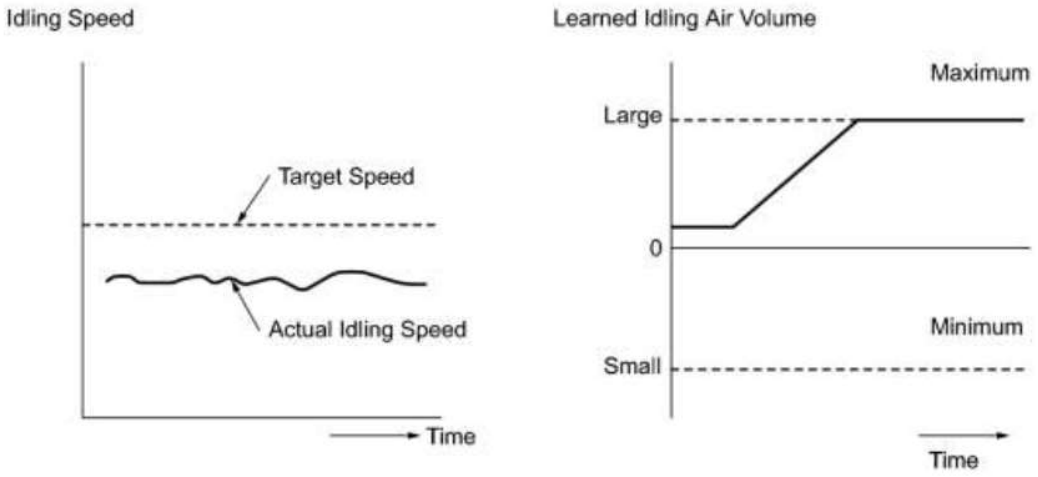
DTC No.	DTC Detection Condition	Trouble Area
P0505	Idling speed continues to vary greatly from target idling speed (2 trip detection logic)	• Electronic throttle control system • Intake system • PCV hose connections • EGR valve assembly • ECM

MONITOR DESCRIPTION

The ECM monitors the idle speed and idle air flow volume to conduct Idle Speed Control (ISC). The ECM determines that the idle speed control system is malfunctioning if the following conditions apply:

- The learned idle air flow volume remains at the maximum or minimum volume for 5 seconds or more during a drive cycle.
- After driving at a vehicle speed of 34.175 mph (55 km/h) or more, the actual engine idle speed varies from the target idle speed by less than -100 rpm or 150 rpm or more, 5 times or more during a driving cycle, the ECM illuminates the MIL and sets the DTC.

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MONITOR STRATEGY

Related DTCs	P0505: Idle speed control function
Required Sensors/Components (Main)	Electronic throttle control system
Required Sensors/Components (Related)	Crankshaft position sensor Engine coolant temperature sensor Vehicle speed sensor
Frequency of Operation	Once per driving cycle
Duration	10 minutes (Idling after warming up)
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	P0010 (VVT Oil Control Valve Bank 1) P0011 (VVT System Bank 1 - Advance) P0012 (VVT System Bank 1 - Retard)

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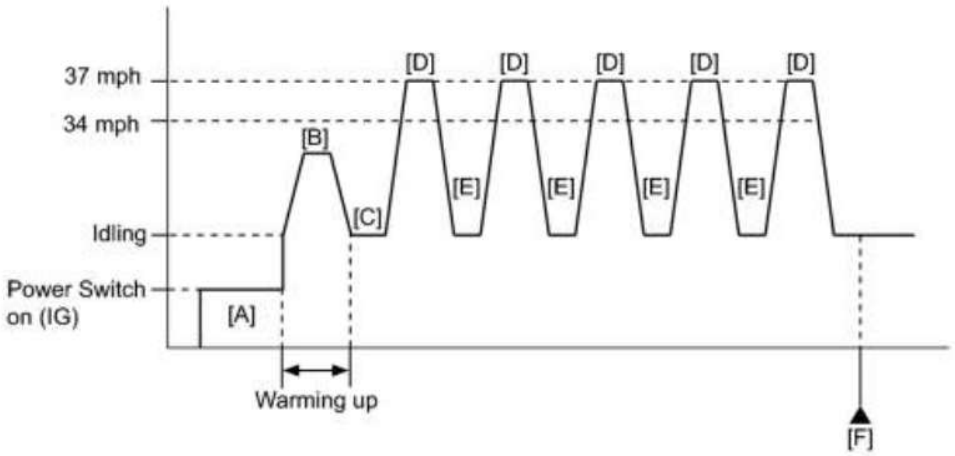
	P0016 (VVT System Bank 1 - Misalignment) P0031, P0032, P101D (Air Fuel Ratio Sensor Heater - Sensor 1) P0102, P0103 (Mass Air Flow Meter) P0107, P0108 (Manifold Absolute Pressure) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0171, P0172 (Fuel System) P0301, P0302, P0303, P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0340, P0342, P0343 (Camshaft Position Sensor) P0351, P0352, P0353, P0354 (Igniter) P0401 (EGR System (Closed)) P0451, P0452, P0453 (EVAP System) P2195, P2196, P2237, P2238, P2239, P2252, P2253, P2A00 (Air Fuel Ratio Sensor - Sensor 1)
Engine	Running

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TYPICAL MALFUNCTION THRESHOLDS

Either of the following conditions is met	Condition 1 or 2
1. Frequency that both of the following conditions (a) and (b) are met	5 times or more
(a) Engine rpm - Target engine rpm	Less than -100 rpm, or 150 rpm or more
(b) Vehicle condition	Stop after vehicle was driven at 34.375 mph (56 km/h) or more
2. Frequency that both of the following conditions (a) and (b) are met	Once
(a). Engine rpm - Target engine rpm	Less than -100 rpm, or 150 rpm or more
(b) Idle air control flow rate learning valve	0.5 L/sec or less, or 6.1 L/sec or more

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Enter the following menus: Powertrain / Engine and ECT / Data List / Coolant Temp.
4. Make sure that the coolant temperature is 60°C (140°F) or less [A].

   HINT:

   If the coolant temperature is 60°C (140°F) or more, the engine may stop when idling. Make sure to keep the coolant temperature at 60°C (140°F) or less during the driving pattern.

5. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
6. Put the engine in inspection mode INFO.
7. Start the engine and drive the vehicle until the coolant temperature reaches 70°C (158°F) [B].
8. Stop the vehicle (0 mph (0 km/h)) [C].
9. Accelerate the vehicle to 34 to 37 mph (55 to 60 km/h) or more, and then idle the engine [D].

   HINT:

   If the vehicle speed reaches more than 37 mph (60 km/h), the engine may stop while decelerating.

10. Stop the vehicle (0 mph (0 km/h)) [E].
11. Repeat steps [D] and [E] for 5 times or more.
12. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
13. Read the pending DTC [F].
14. If a pending DTC is output, the system is malfunctioning.

    HINT:

    If a pending DTC is not output, perform the following procedure.

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15. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
16. Input the DTC: P0505.
17. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, repeat steps [D] and [E] for 5 times or more.

18. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
19. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

20. If the test result is INCOMPLETE or UNKNOWN, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If a permanent DTC is not output, the system is normal.

INSPECTION PROCEDURE

HINT:

- The following conditions may also cause DTC P0505 to be set:
  a. The floor carpet overlapping slightly onto the accelerator pedal, causing the accelerator pedal to be slightly depressed and therefore the throttle valve position to be slightly open.
  b. The accelerator pedal being not fully released.

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- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0505)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result:

Result	Proceed to
DTC P0505 is output	A
DTC P0505 and other DTCs are output	B

HINT:

If any DTCs other than P0505 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK PCV HOSE CONNECTIONS

(a) Check the PCV hose connections.

OK:

PCV hose is connected correctly and is not damaged.

NG ▶ REPAIR OR REPLACE PCV HOSE

OK ▼

3.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO.

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OK:

No leaks from the intake system.

NG ▶ REPAIR OR REPLACE INTAKE SYSTEM

OK ▼

4.	INSPECT THROTTLE BODY ASSEMBLY (VISUALLY CHECK THROTTLE VALVE)

(a) Check for contamination between the throttle valve and the housing and then check that the throttle valve moves smoothly.

OK:

Throttle valve is not contaminated with foreign objects and moves smoothly.

NG ▶ REPLACE THROTTLE BODY ASSEMBLY

OK ▼

5.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

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Standard:

-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

Result:

Result	Proceed to
Outside of standard range	A
Within standard range	B

B ▶ REPLACE ECM

A ▼

6.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

NG ▶ REPLACE EGR VALVE ASSEMBLY

OK ▼

7.	REPLACE ECM

(a) Replace the ECM INFO.

NEXT ▼

8.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

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(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTC INFO.

(e) Turn the power switch off and wait for 30 seconds.

(f) Turn the power switch on (IG) and turn the Techstream on.

(g) Put the engine in inspection mode INFO.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(k) Input the DTC: P0505.

(l) Check the DTC judgment result.

NEXT ▶ **END**

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DTC	P050A	Cold Start Idle Air Control System Performance

MONITOR DESCRIPTION

This monitor will run when the engine is started at an engine coolant temperature of -10 to 50°C (14 to 122°F). The DTC can be set after the engine idles for 13 seconds (2 trip detection logic).

The DTC is designed to monitor the idle air control at cold start. When the engine is started at an engine coolant temperature of lower than 50°C (122°F), the ECM measures the accumulated mass air flow at idle. If it does not reach the specified level within 10 seconds, the ECM interprets this as a malfunction. The MIL is illuminated and a DTC is set when the malfunction is detected in consecutive driving cycles (2 trip detection logic).

The electronic throttle control system controls the idle speed. The electronic throttle control system operates the throttle actuator to open and close the throttle valve, and adjusts the intake air amount to achieve the target idle speed.

NOTICE:

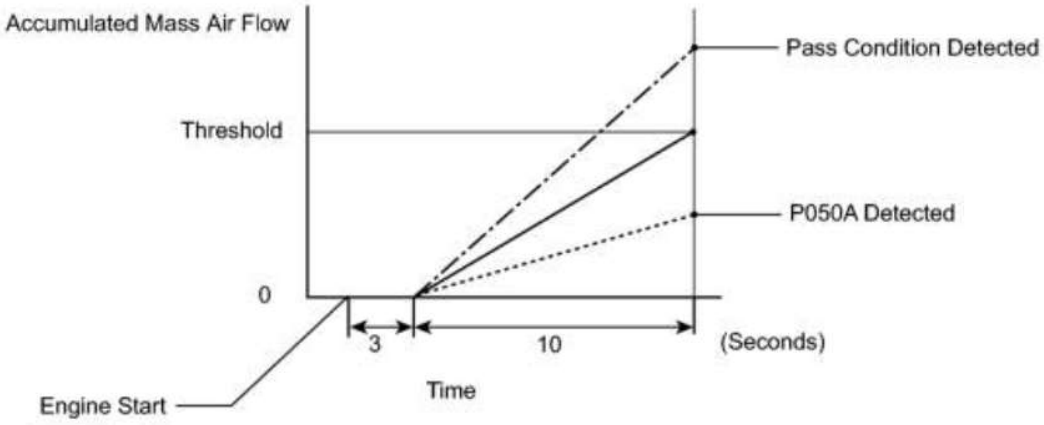
When the negative battery terminal is disconnected during inspection or repairs, the idle speed control (ISC) learned values are cleared. Idle speed control learning needs to be performed before this DTC can be stored. To perform idle speed control learning, the engine must be warmed up by allowing it to idle for 5 minutes. For idle speed control learning to be successful, when the engine is started to warm it up, there must be at least 10 seconds of idling with the coolant temperature below 50°C (122°F) before allowing it to continue running for the 5 minute learning period.

HINT:

The idle speed control learning is performed when the engine is warmed up and has been idling for 5 minutes.

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P050A Detection Logic:



Engine Coolant Temperature: -10 to 50°C

DTC No.	DTC Detection Condition	Trouble Area
P050A	Insufficient mass air flow at cold start (2 trip detection logic)	• Throttle body assembly • Mass air flow meter sub-assembly • PCV system • Air cleaner filter element sub-assembly • Intake system • VVT system • EGR valve assembly • ECM

MONITOR STRATEGY

Related DTCs	P050A: Idle speed control problem at cold
Required Sensors/Components (Main)	Mass air flow meter sub-assembly
Required Sensors/Components (Related)	Engine coolant temperature sensor, throttle position sensor, vehicle speed sensor
Frequency of Operation	Once per driving cycle
Duration	10 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

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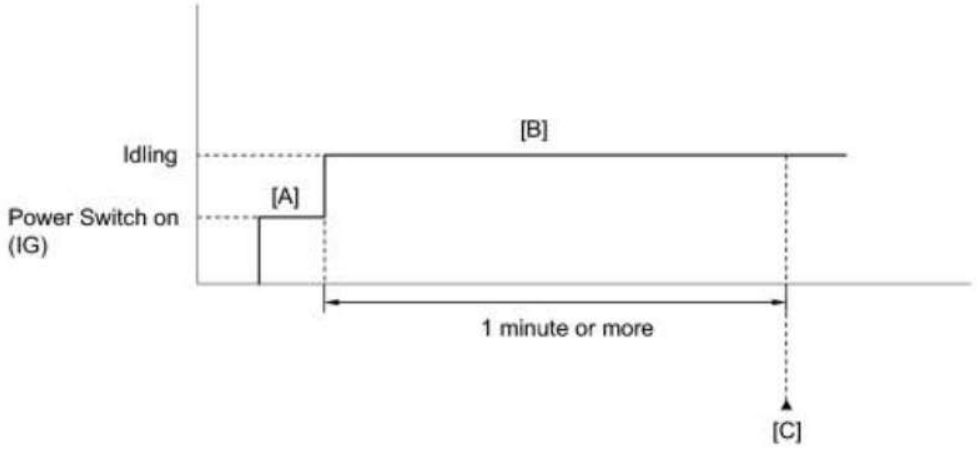
Monitor runs whenever following DTCs are not present	P0010 (VVT Oil Control Valve Bank 1) P0011 (VVT System Bank 1- Advance) P0012 (VVT System Bank 1- Retard) P0016 (VVT System Bank 1 - Misalignment) P0102, P0103 (Mass Air Flow Meter) P0107, P0108 (Manifold Absolute Pressure) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0171, P0172 (Fuel System) P0301, P0302, P0303, P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0340, P0342, P0343 (Camshaft Position Sensor) P0351, P0352, P0353, P0354 (Igniter) P0401 (EGR System (Closed)) P2195, P2196, P2237, P2238, P2239, P2252, P2253, P2A00 (Air Fuel Ratio Sensor - Sensor 1)
Battery voltage	8 V or more
Time after engine start	0 second or more
Starter	OFF
Engine coolant temperature at engine start	-10°C (14°F) or more
Engine coolant temperature	-10 to 50°C (14 to 122°F)
Engine idling time	3 second or more
Fuel-cut	OFF
Vehicle speed	Less than 37.5 mph (60 km/h)
Atmospheric pressure	76 kPa (570 mmHg) or more

TYPICAL MALFUNCTION THRESHOLDS

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Accumulated mass air flow	Less than 42.5 g (varies with engine coolant temperature)

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Enter the following menus: Powertrain / Engine and ECT / Data List / All Data / Coolant Temp.
7. Check that "Coolant Temp" in the Data List is within the range of -10 to 50°C (14 to 122°F).
8. Put the engine in inspection mode INFO.
9. Start the engine and warm it up until the coolant temperature is the same as the coolant temperature in the freeze frame data.
10. Idle the engine for 1 minute or more [B].
11. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
12. Read the pending DTC [C].
13. If a pending DTC is output, the system is malfunctioning.

    HINT:

    If a pending DTC is not output, perform the following procedure.

14. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Input the DTC: P050A.
16. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed

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Techstream Display	Description
	○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, idle the engine for 3 minutes, let the engine cool down, and then perform steps [A] through [B].

17. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
18. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

19. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P050A)

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(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result:

Result	Proceed to
DTC P050A is output	A
DTC P050A and other DTCs are output	B

HINT:

If any DTCs other than P050A are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	READ VALUE USING TECHSTREAM (FUEL TRIM)

HINT:

Calculate the total fuel trim values to check the characteristic deviation of the mass air flow meter sub-assembly.

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Short FT #1 and Long FT #1.

(e) Read the values displayed on the Techstream.

(f) Add together the Short FT #1 and Long FT #1 values to obtain the total Fuel Trim.

OK:

Total of Short FT #1 and Long FT #1 values is between -20% and 20%.

NG ▶ CHECK PCV HOSE

OK ▼

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3.	INSPECT THROTTLE BODY ASSEMBLY

(a) Check that there are no deposits around the throttle valve.

OK:

No deposits around the throttle valve.

NG ▶ REPAIR OR REPLACE THROTTLE BODY ASSEMBLY

OK ▼

4.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR VALVE STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling	Steady idling	Idling changes from steady to rough idling

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-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
condition		
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

Result:

Result	Proceed to
Outside of standard range	A
Within standard range	B

B ▶ REPLACE ECM

A ▼

5.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

NG ▶ REPLACE EGR VALVE ASSEMBLY

OK ▼

6.	REPLACE ECM

(a) Replace the ECM INFO.

NEXT ▶ CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

7.	REPAIR OR REPLACE THROTTLE BODY ASSEMBLY

(a) Repair or replace the throttle body assembly INFO.

NEXT ▶ CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

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8.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

NOTICE:

In this operation, the engine must be cold (the same level as the engine coolant temperature recorded in the freeze frame data).

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Turn the power switch off and wait for 30 seconds.

(f) Turn the power switch on (IG) and turn the Techstream on.

(g) Put the engine in inspection mode INFO.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(k) Input the DTC: P050A.

(l) Check the DTC judgment result.

NEXT ▶ **END**

9.	CHECK PCV HOSE

(a) Check the PCV hose connections.

OK:

PCV hose is connected correctly and is not damaged.

NG ▶ REPAIR OR REPLACE PCV HOSE

OK ▼

10.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO.

OK:

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No leaks from the intake system.

NG ▶ REPAIR OR REPLACE INTAKE SYSTEM

OK

▼

11.	CHECK AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

(a) Visually check that the air cleaner filter element sub-assembly is not excessively contaminated with dirt or oil.

OK:

The air cleaner filter element sub-assembly is not excessively contaminated with dirt or oil.

NG ▶ REPLACE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

OK

▼

12.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR VALVE POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

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-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

Result:

Result	Proceed to
Outside of standard range	A
Within standard range	B

B ▶ PERFORM ACTIVE TEST USING TECHSTREAM (OPERATE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY)

A ▼

13.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

NG ▶ REPLACE EGR VALVE ASSEMBLY

OK ▼

14.	PERFORM ACTIVE TEST USING TECHSTREAM (OPERATE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

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(d) Put the engine in inspection mode INFO.

(e) Start the engine.

(f) Turn the Techstream on.

(g) Warm up the engine.

(h) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the VVT System (Bank 1).

(i) Check the engine speed while operating the camshaft timing oil control valve assembly using the Techstream.

Result:

Techstream Operation	Specified Condition
OFF	Normal engine speed
ON	Engine idles roughly or stalls (soon after camshaft timing oil control valve assembly switched from OFF to ON)

HINT:

If the result is not acceptable, cool the engine and perform the Active Test again.

(j) Start the engine when the engine coolant temperature is 30°C (86°F) or less.

(k) Turn the Techstream on.

(l) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the VVT System (Bank 1).

(m) Check the engine speed while operating the camshaft timing oil control valve assembly using the Techstream with the engine coolant temperature at 50°C (122°F) or less.

Result:

Techstream Operation	Specified Condition
OFF	Normal engine speed
ON	Engine idles roughly or stalls (soon after camshaft timing oil control valve assembly switched from OFF to ON)

NG ▶ CHECK AND REPAIR VVT SYSTEM

OK ▼

15.	REPLACE MASS AIR FLOW METER SUB-ASSEMBLY

(a) Replace the mass air flow meter sub-assembly INFO.

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NEXT ▶ CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED (DTC P050A)

16.	REPAIR OR REPLACE PCV HOSE

(a) Repair or replace the PCV hose.

NEXT ▶ CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED (DTC P050A)

17.	REPAIR OR REPLACE INTAKE SYSTEM

(a) Repair or replace the intake system.

NEXT ▶ CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED (DTC P050A)

18.	REPLACE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

(a) Replace the air cleaner filter element sub-assembly.

NEXT ▶ CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED (DTC P050A)

19.	REPLACE EGR VALVE ASSEMBLY

(a) Replace the EGR valve assembly INFO.

NEXT ▶ CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED (DTC P050A)

20.	CHECK AND REPAIR VVT SYSTEM

HINT:

Check the VVT system.

NEXT ▼

21.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED (DTC P050A)

NOTICE:

In this operation, the engine must be cold (the same level as the engine coolant temperature recorded in the freeze frame data).

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Turn the power switch off and wait for 30 seconds.

(f) Turn the power switch on (IG) and turn the Techstream on.

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(g) Put the engine in inspection mode INFO.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(k) Input the DTC: P050A.

(l) Check the DTC judgment result.

NEXT ▶ **END**

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DTC	P050B	Cold Start Ignition Timing Performance

DESCRIPTION

This monitor will run when the engine is started at -10 to 50°C (14 to 122°F) of the engine coolant temperature. The DTC can be set after the engine idles for 13 seconds or more (2 trip detection logic).

The DTC is designed to monitor the idle air control at cold start. When the engine is started at lower than 50°C (122°F) of the engine coolant temperature, the ECM measures the accumulated mass air flow at idle. If it does not reach the criteria within 10 seconds, the ECM interprets this as a malfunction. The MIL is illuminated and a DTC is set when the malfunction is detected in consecutive driving cycles (2 trip detection logic).

The electronic throttle control system controls the idle speed. The electrical throttle control system operates the throttle actuator to open and close the throttle valve, and adjusts the intake air amount to achieve the target idle speed.

NOTICE:

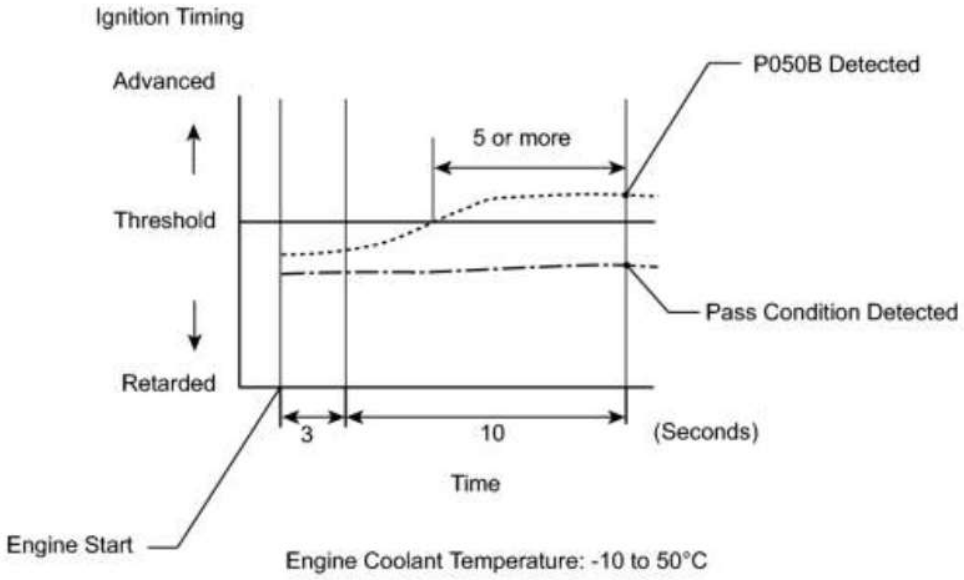
When the negative (-) battery terminal is disconnected during inspection or repairs, the idle speed control learned values are cleared. Idle speed control learning is performed when the engine has been warmed up and idled for 5 minutes because this DTC cannot be set after the idle speed control learned values are cleared.

DTC No.	DTC Detection Condition	Trouble Area
P050B	Ignition timing retard value insufficient for 5 seconds or more for 10 seconds of P050A monitoring duration at cold start (2 trip detection logic)	• Throttle body assembly • Mass air flow meter sub-assembly • Intake system • PCV hose connections • VVT system • Air cleaner filter element sub-assembly • EGR valve assembly • ECM

MONITOR DESCRIPTION

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P050B Detection Logic:



MONITOR STRATEGY

Related DTCs	P050B: Idle ignition timing problem at cold
Required Sensors / Components (Main)	Mass air flow meter sub-assembly
Required Sensors / Components (Related)	Engine coolant temperature sensor, throttle position sensor, vehicle speed sensor
Frequency of Operation	Once per driving cycle
Duration	10 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	P0010 (VVT Oil Control Valve Bank 1) P0011 (VVT System Bank 1- Advance) P0012 (VVT System Bank 1- Retard) P0016 (VVT System Bank 1 - Misalignment)

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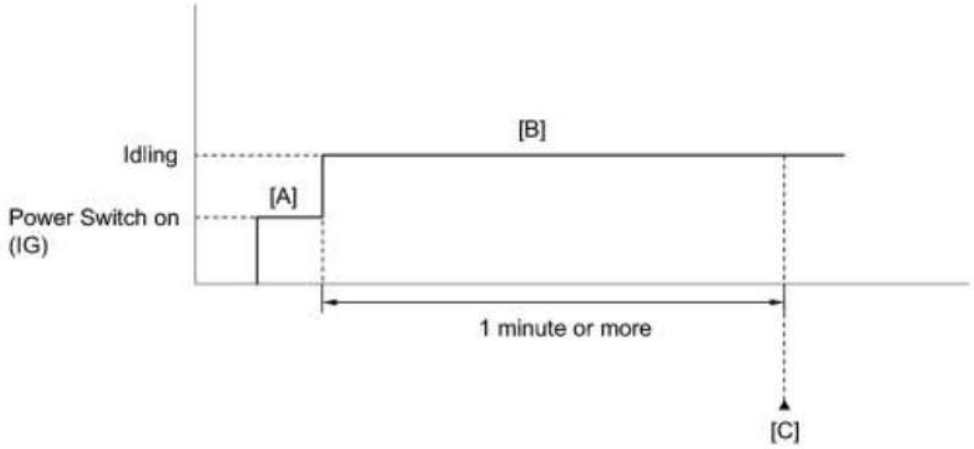
	P0102, P0103 (Mass Air Flow Meter) P0107, P0108 (Manifold Absolute Pressure) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0171, P0172 (Fuel System) P0301, P0302, P0303, P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0340, P0342, P0343 (Camshaft Position Sensor) P0351, P0352, P0353, P0354 (Igniter) P0401 (EGR System (Closed)) P2195, P2196, P2237, P2238, P2239, P2252, P2253, P2A00 (Air Fuel Ratio Sensor - Sensor 1)
Battery voltage	8 V or more
Time after engine start	3 seconds or more
Starter	OFF
Engine coolant temperature at engine start	-10°C (14°F) or more
Engine coolant temperature	-10 to 50°C (14 to 122°F)
Engine idling time	0 second or more
Fuel-cut	OFF
Vehicle speed	Less than 37.5 mph (60 km/h)
Atmospheric pressure	76 kPa (570 mmHg) or more

TYPICAL MALFUNCTION THRESHOLDS

Accumulated time when ignition timing retard is cut off	5 seconds or more

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Enter the following menus: Powertrain / Engine and ECT / Data List / All Data / Coolant Temp.
7. Check that "Coolant Temp" in the Data List is within the range of -10 to 50°C (14 to 122°F).
8. Put the engine in inspection mode INFO.
9. Start the engine and warm it up until the coolant temperature is the same as the coolant temperature in the freeze frame data.
10. Idle the engine for 1 minute or more [B].
11. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
12. Read the pending DTC [C].
13. If a pending DTC is output, the system is malfunctioning.

    HINT:

    If a pending DTC is not output, perform the following procedure.

14. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Input the DTC: P050B.
16. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal

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Techstream Display	Description
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, idle the engine for 3 minutes, let the engine cool down, and then perform steps [A] through [B].

17. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
18. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

19. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

- DTC P050B may be set when the engine shows the symptom as listed below. If necessary, check the trouble area as listed below.

Symptom	Factor	Trouble Area
Low idle speed at engine cold.	Excessive engine friction	Engine oil deterioration
Rough idle at engine cold.	Abnormal combustion	Fuel quality

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

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1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P050B)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following the menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result:

Result	Proceed to
DTC P050B is output	A
DTC P050B and other DTCs are output	B

HINT:

If any DTCs other than P050B are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	READ VALUE USING TECHSTREAM (FUEL TRIM)

HINT:

Calculate the total fuel trim values to check the characteristic deviation of the mass air flow meter sub-assembly.

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG) and turn the Techstream on.

(c) Put the engine in inspection mode INFO.

(d) Start the engine.

(e) Enter the following menus: Powertrain / Engine and ECT / Active Test / Short FT #1 and Long FT #1.

(f) Read the values displayed on the Techstream at engine idle.

(g) Add together the Short FT #1 and Long FT #1 values to obtain the total fuel trim.

OK:

Total of Short FT #1 and Long FT #1 values is between -20 % and 20 %.

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NG ▶ CHECK PCV HOSE (HOSE CONNECTIONS)

OK

▼

3.	CHECK THROTTLE BODY ASSEMBLY

(a) Check for deposits around the throttle valve and throttle valve condition.

OK:

No deposits around throttle valve and throttle valve moves smoothly.

NG ▶ REPAIR OR REPLACE THROTTLE BODY ASSEMBLY

OK

▼

4.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

-	**EGR Step Position (Active Test)**

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	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

Result:

Result	Proceed to
Outside of standard range	A
Within standard range	B

B ▶ REPLACE ECM

A ▼

5.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

NG ▶ REPLACE EGR VALVE ASSEMBLY

OK ▼

6.	REPLACE ECM

(a) Replace the ECM INFO.

NEXT ▶ CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED (DTC P050B)

7.	REPAIR OR REPLACE THROTTLE BODY ASSEMBLY

(a) Repair or replace the throttle body assembly INFO.

NEXT

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8.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED (DTC P050B)

NOTICE:

In this operation, the engine must be cold (the same level as the engine coolant temperature recorded in the freeze frame data).

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Turn the power switch off and wait for 30 seconds.

(f) Turn the power switch on (IG) and turn the Techstream on.

(g) Put the engine in inspection mode INFO.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(k) Input the DTC: P050B.

(l) Check the DTC judgment result.

NEXT ▶ **END**

9.	CHECK PCV HOSE (HOSE CONNECTIONS)

(a) Check the PCV hose connections.

OK:

PCV hose is connected correctly and is not damaged.

NG ▶ REPAIR OR REPLACE PCV HOSE

OK

10.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO.

OK:

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No leaks in intake system.

NG ▶ REPAIR OR REPLACE INTAKE SYSTEM

OK

▼

11.	CHECK AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

(a) Visually check that the air cleaner filter element sub-assembly is not excessively contaminated with dirt or oil.

OK:

Air cleaner filter element sub-assembly is not excessively contaminated with dirt or oil.

NG ▶ REPLACE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

OK

▼

12.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

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-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

Result:

Result	Proceed to
Outside of standard range	A
Within standard range	B

B ▶ PERFORM ACTIVE TEST USING TECHSTREAM (OPERATE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY)

A ▼

13.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

NG ▶ REPLACE EGR VALVE ASSEMBLY

OK ▼

14.	PERFORM ACTIVE TEST USING TECHSTREAM (OPERATE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

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(d) Put the engine in inspection mode INFO.

(e) Start the engine.

(f) Turn the Techstream on.

(g) Warm up the engine.

(h) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the VVT System (Bank 1).

(i) Check the engine speed while operating the camshaft timing oil control valve assembly using the Techstream.

Result:

Techstream Operation	Specified Condition
OFF	Normal engine speed
ON	Engine idles roughly or stalls (soon after camshaft timing oil control valve assembly switched from OFF to ON)

HINT:

If the result is not acceptable, cool the engine and perform the Active Test again.

(j) Start the engine when the engine coolant temperature is 30°C (86°F) or less.

(k) Turn the Techstream on.

(l) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the VVT System (Bank 1).

(m) Check the engine speed while operating the camshaft timing oil control valve assembly using the Techstream with the engine coolant temperature at 50°C (122°F) or less.

Result:

Techstream Operation	Specified Condition
OFF	Normal engine speed
ON	Engine idles roughly or stalls (soon after camshaft timing oil control valve assembly switched from OFF to ON)

NG ▶ CHECK AND REPAIR VVT SYSTEM

OK ▼

15.	REPLACE MASS AIR FLOW METER SUB-ASSEMBLY

(a) Replace the mass air flow meter sub-assembly INFO.

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NEXT ▶ CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED (DTC P050B)

16.	REPAIR OR REPLACE PCV HOSE

(a) Repair or replace the PCV hose.

NEXT ▶ CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED (DTC P050B)

17.	REPAIR OR REPLACE INTAKE SYSTEM

(a) Repair or replace the intake system.

NEXT ▶ CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED (DTC P050B)

18.	REPLACE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

(a) Replace the air cleaner filter element sub-assembly.

NEXT ▶ CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED (DTC P050B)

19.	REPLACE EGR VALVE ASSEMBLY

(a) Replace the EGR valve assembly INFO.

NEXT ▶ CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED (DTC P050B)

20.	CHECK AND REPAIR VVT SYSTEM

(a) Check and repair the VVT system.

NEXT ▼

21.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED (DTC P050B)

NOTICE:

In this operation, the engine must be cold (the same level as the engine coolant temperature recorded in the freeze frame data).

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Turn the power switch off and wait for 30 seconds.

(f) Turn the power switch on (IG) and turn the Techstream on.

(g) Put the engine in inspection mode INFO.

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(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(k) Input the DTC: P050B.

(l) Check the DTC judgment result.

NEXT ▶ **END**

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DTC	P0560	System Voltage

MONITOR DESCRIPTION

The battery supplies electricity to the ECM even when the power switch is off. This power allows the ECM to store data such as DTC history, freeze frame data and fuel trim values. If the battery voltage falls below a minimum level, the memory is cleared and the ECM determines that there is a malfunction in the power supply circuit. The next time the engine is started, the ECM illuminates the MIL and sets the DTC.

DTC No.	DTC Detection Condition	Trouble Area
P0560	Open in ECM back up power source circuit (1 trip detection logic)	• Open in back up power source circuit • Battery • Battery terminals • EFI MAIN fuse • ECM

HINT:

If DTC P0560 is set, the ECM does not store other DTCs or the data stored in the ECM may be partly cleared.

MONITOR STRATEGY

Related DTCs	P0560: ECM system voltage
Required Sensors/Components (Main)	ECM
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	3 seconds
MIL Operation	Immediately (MIL illuminated after next engine start)
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

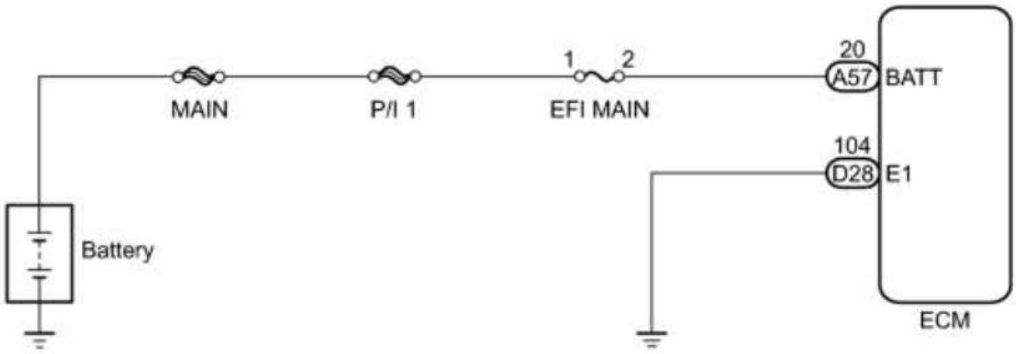
Monitor runs whenever following DTCs are not present	None

TYPICAL MALFUNCTION THRESHOLDS

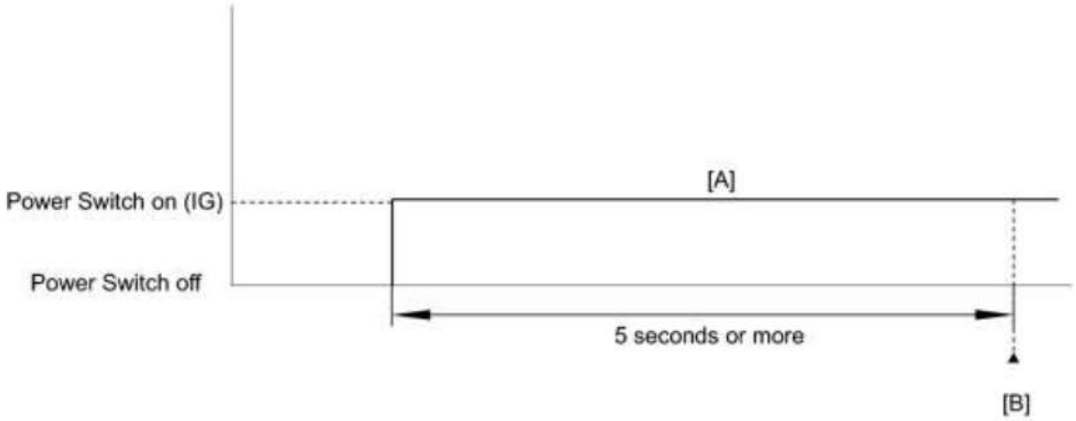
ECM power source	Less than 3.5 V

WIRING DIAGRAM

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CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on.
6. Wait 5 seconds or more [A].
7. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
8. Read the DTC [B].
9. If a DTC is output, the system is malfunctioning.

HINT:

If a DTC is not output, perform the following procedure.

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10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P0560.
12. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [A] again.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

15. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

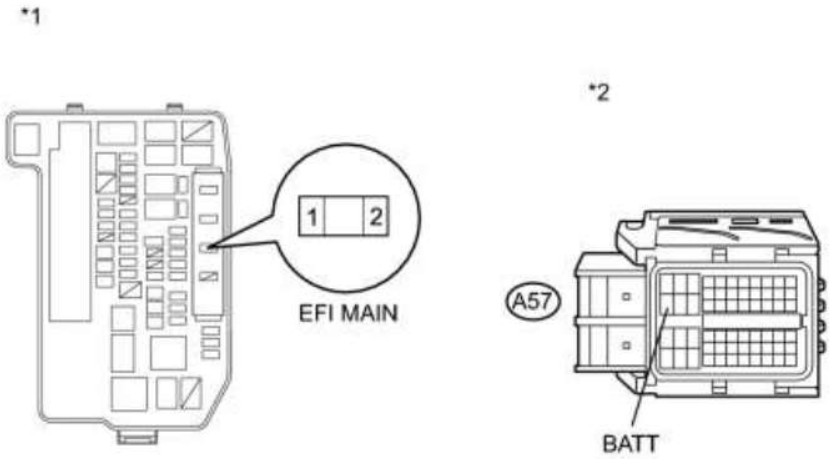
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Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	CHECK HARNESS AND CONNECTOR (ECM - EFI MAIN FUSE)

(a) Disconnect the negative battery terminal.



(b) Disconnect the positive battery terminal.

(c) Remove the EFI MAIN fuse from the engine room relay block.

(d) Disconnect the ECM connector.

(e) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
EFI MAIN fuse (2) - A57-20 (BATT)	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
EFI MAIN fuse (2) or A57-20 (BATT) - Body ground	Always	10 kΩ or higher

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Text in Illustration

*1	Engine Room Relay Block	*2	Front view of wire harness connector (to ECM)

(f) Reinstall the EFI MAIN fuse.

(g) Reconnect the ECM connector.

(h) Reconnect the positive battery terminal.

(i) Reconnect the negative battery terminal.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - EFI MAIN FUSE)
OK
▼

2.	INSPECT BATTERY

(a) Check that the battery is not discharged or weak.

OK:

Battery is not discharged or weak.

NG ▶ CHARGE OR REPLACE BATTERY
OK
▼

3.	CHECK BATTERY TERMINAL

(a) Check that the battery terminals are not loose or corroded.

OK:

Battery terminals are not loose or corroded.

NG ▶ REPAIR OR REPLACE BATTERY TERMINAL
OK
▼

4.	CHECK WHETHER DTC OUTPUT RECURS

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

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(e) Turn the power switch off and turn the Techstream off.

(f) Turn the power switch on (IG) and turn the Techstream on.

(g) Wait for 5 seconds.

(h) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(i) Read the DTCs.

Result:

Result	Proceed to
DTC P0560 is output	A
DTC is not output	B

B ▶ CHECK FOR INTERMITTENT PROBLEMS

A ▶ **REPLACE ECM**

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DTC	P0604	Random Access Memory (RAM)

MONITOR DESCRIPTION

The ECM continuously monitors its internal memory status. This self-check ensures that the ECM is functioning properly. It is diagnosed by internal "mirroring" of the main CPU and sub CPU to detect Random Access Memory (RAM) errors. If outputs from these CPUs are different and deviate from the standards, the ECM will illuminate the MIL and set the DTC immediately.

DTC No.	DTC Detection Condition	Trouble Area
P0604	ECM RAM errors	ECM

MONITOR STRATEGY

Related DTCs	P0604: ECM RAM error
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	None
Frequency of operation	Continuous
Duration	6 times
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

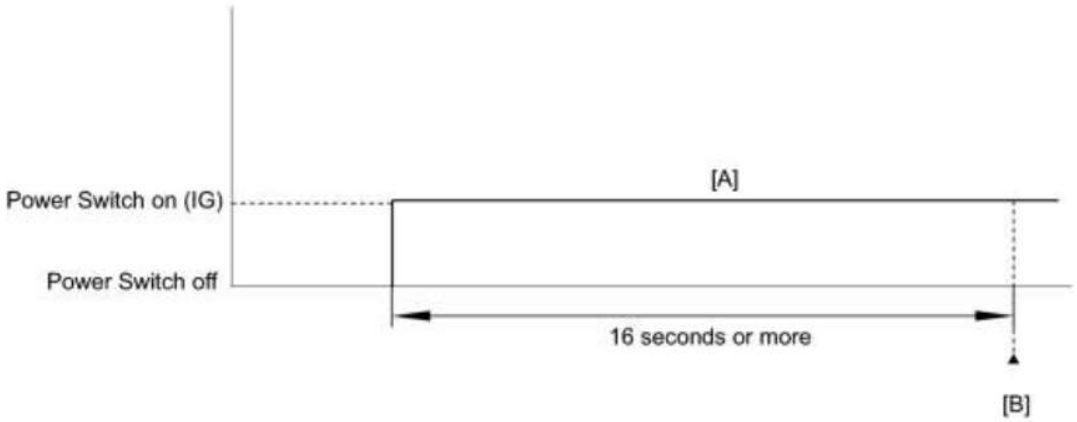
Monitor runs whenever following DTCs are not present	None

TYPICAL MALFUNCTION THRESHOLDS

RAM mirror check	Fail

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on.
6. Wait 16 seconds or more [A].
7. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
8. Read the DTC [B].
9. If a DTC is output, the system is malfunctioning.

   HINT:

   If a DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P0604.
12. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment

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Techstream Display	Description
	○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [A] again.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

15. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	READ OUTPUT DTC (DTC P0604)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Turn the power switch off and turn the Techstream off.

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(f) Disconnect the Techstream.

(g) Disconnect the cable from the battery negative (-) terminal and wait for 1 minute.

(h) Connect the cable to the battery negative (-) terminal.

(i) Connect the Techstream to the DLC3.

(j) Turn the power switch on (IG).

(k) Wait 16 seconds or more.

(l) Turn the Techstream on.

(m) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(n) Read the DTCs.

Result:

Result	Proceed to
DTC is not output	A
DTC P0604 is output	B

B ▶ REPLACE ECM

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

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DTC	P0606	ECM / PCM Processor

MONITOR DESCRIPTION

The ECM continuously monitors its main and sub CPUs. This self-check ensures that the ECM is functioning properly. If outputs from the CPUs are different and deviate from the standards, the ECM will illuminate the MIL and set the DTC immediately.

DTC No.	DTC Detection Condition	Trouble Area
P0606	ECM main CPU error	ECM

MONITOR STRATEGY

Related DTC	P0606: ECM range check
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	Within 1 second
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

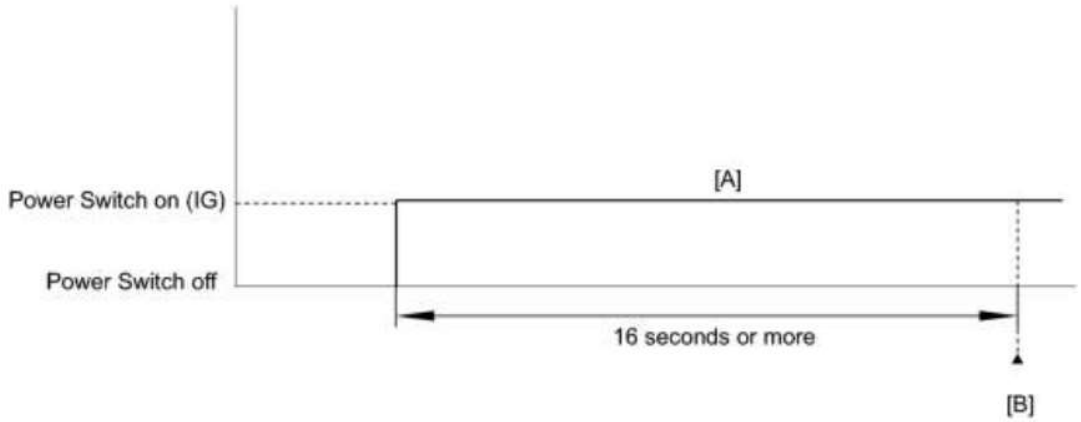
Monitor runs whenever the following DTCs are not present	None

TYPICAL MALFUNCTION THRESHOLDS

Either of the following conditions is met:	Condition A or B
A. DMA communication	No response
B. Watching from monitoring processor	Not toggle

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on.
6. Wait 16 seconds or more [A].
7. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
8. Read the DTC [B].
9. If a DTC is output, the system is malfunctioning.

   HINT:

   If a DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P0606.
12. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment

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Techstream Display	Description
	○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [A] again.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

15. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	READ OUTPUT DTC (DTC P0606)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Turn the power switch off and turn the Techstream off.

(f) Disconnect the Techstream.

(g) Disconnect the cable from the battery negative (-) terminal and wait for 1 minute.

(h) Connect the cable to the battery negative (-) terminal.

(i) Connect the Techstream to the DLC3.

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(j) Turn the power switch on (IG).

(k) Wait 16 seconds or more.

(l) Turn the Techstream on.

(m) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(n) Read the DTCs.

Result:

Result	Proceed to
DTC is not output	A
DTC P0606 is output	B

B ▶ REPLACE ECM

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

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DTC	P0607	Control Module Performance

MONITOR DESCRIPTION

The ECM continuously monitors its internal processors (CPUs) and heated oxygen sensor transistors. This self-check ensures that the ECM is functioning properly.

DTC No.	DTC Detection Condition	Trouble Area
P0607	• ECM CPUs malfunction • Heated oxygen sensor transistor (built into the ECM) malfunctions	• ECM • Heated oxygen sensor • Exhaust gas leak
	For Mexico models: ECM CPU error	• ECM

MONITOR STRATEGY

Related DTCs	P0607: Control Module Performance
Required Sensors/Components (Main)	ECM
Required Sensors/Components (Related)	Heated oxygen sensor
Frequency of Operation	Continuous
Duration	60 seconds
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

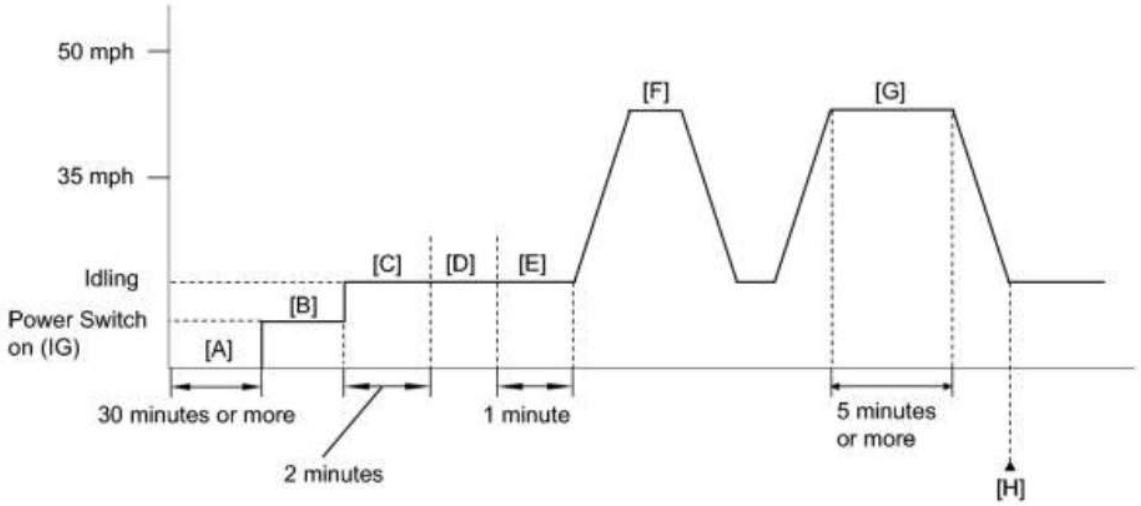
Monitor runs whenever the following DTCs are not stored	None
Engine	Running
Estimated heated oxygen sensor temperature	450 to 750°C (842 to 1382°F)

TYPICAL MALFUNCTION THRESHOLDS

Heated oxygen sensor transistors	Fail

CONFIRMATION DRIVING PATTERN

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1. Stop the engine for 30 minutes or more [A].
2. Connect the Techstream to the DLC3.
3. Turn the power switch on (IG) and turn the Techstream on.
4. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
5. Turn the power switch off and wait for 30 seconds.
6. Turn the power switch on (IG) and turn the Techstream on [B].
7. Put the engine in inspection mode INFO.
8. Start the engine, and wait 2 minutes [C].
9. Warm up the engine until the engine coolant temperature is 75°C (167°F) or higher [D].
10. Idle the engine for 1 minute [E].
11. Accelerate the vehicle to 50 mph (80 km/h) and stop the vehicle [F].
12. Drive the vehicle at 35 to 50 mph (56 to 80 km/h) for 5 minutes or more [G].
13. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
14. Read the pending DTC [H].
15. If a pending DTC is output, the system is malfunctioning.

HINT:

If a pending DTC is not output, perform the following procedure.

16. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
17. Input the DTC: P0607, P0136, P0137 or P0138.
18. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed

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Techstream Display	Description
	○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [D] through [G].

19. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
20. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

21. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

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(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result:

Result	Proceed to
P0607 and P0136, P0137 or P0138 are output	A
P0607 is output	B

B ▶ CHECK FOR EXHAUST GAS LEAK

A ▼

2.	INSPECT DTC (P0136, P0137 OR P0138)

(a) Inspect the P0136, P0137 or P0138 flowchart.

HINT:

- If P0136 is output, troubleshoot for that DTC first INFO. Then proceed to "INSPECT ECM".
- If P0137 is output, troubleshoot for that DTC first INFO. Then proceed to "INSPECT ECM".
- If P0138 is output, troubleshoot for that DTC first INFO. Then proceed to "INSPECT ECM".
- If DTC P0607 and P0136, P0137 or P0138 are output, the output voltage of the heated oxygen sensor may remain close to 0 V or become high (around 1 V or more).

NEXT ▶ INSPECT ECM

3.	CHECK FOR EXHAUST GAS LEAK

(a) Put the engine in inspection mode INFO.

(b) Allow the engine to idle and rev the engine.

(c) Check for exhaust gas leaks around the heated oxygen sensor.

If any exhaust gas leaks are present, repair them and proceed to "PERFORM CONFIRMATION DRIVING PATTERN". If no exhaust gas leaks are present, proceed to "PERFORM CONFIRMATION DRIVING PATTERN".

HINT:

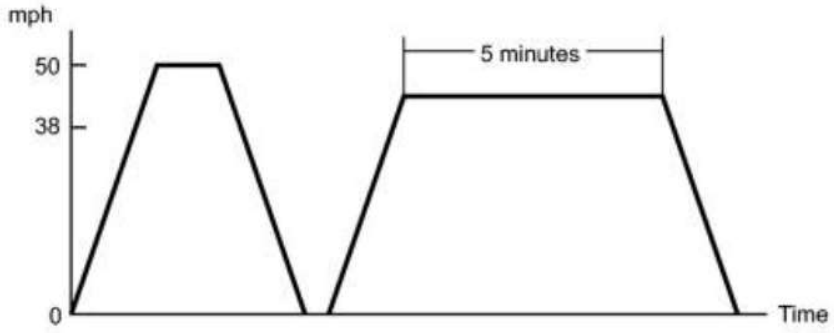
- If no exhaust gas leaks are present, a malfunction in the heated oxygen sensor circuit is suspected.
- If any exhaust gas leaks are present around the heated oxygen sensor, noise appears in the output voltage of the heated oxygen sensor.

NEXT ▼

4.	PERFORM CONFIRMATION DRIVING PATTERN

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Engine Coolant Temperature: 75°C or more



(a) Clear the DTC INFO.

(b) Connect the Techstream to the DLC3.

(c) Turn the power switch on (IG) and turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine.

(f) Warm up the engine until the engine coolant temperature becomes 75°C (167°F) or more.

(g) Perform the driving pattern.

(1) Accelerate the vehicle to 50 mph (80 km/h) and stop the vehicle.

(2) Drive the vehicle between 38 and 50 mph (60 and 80 km/h) for 5 minutes.

(h) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(i) Read the DTCs.

Result:

Result	Proceed to
P0607 and P0136, P0137 or P0138 are output	A
Only P0607	B
No DTC output	C

C ▶ INSPECT ECM
B ▶ REPLACE ECM
A ▼

5.	INSPECT DTC (P0136, P0137 OR P0138)

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(a) Inspect the P0136, P0137 or P0138 flowchart.

HINT:

- If P0136 is output, troubleshoot for that DTC first INFO. Then proceed to "INSPECT ECM".
- If P0137 is output, troubleshoot for that DTC first INFO. Then proceed to "INSPECT ECM".
- If P0138 is output, troubleshoot for that DTC first INFO. Then proceed to "INSPECT ECM".
- If DTC P0607 and P0136, P0137 or P0138 are output, the output voltage of the heated oxygen sensor may remain close to 0 V or become high (around 1 V or more).

NEXT

6.	INSPECT ECM

(a) Clear the DTC INFO.

(b) Stop the engine and wait for 30 minutes.

(c) Connect the Techstream to the DLC3.

(d) Turn the power switch on (IG) and turn the Techstream on.

(e) Put the engine in inspection mode INFO.

(f) Start the engine and allow it to idle for 2 minutes.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Check the DTCs.

Result:

Result	Proceed to
DTC is not output	A
P0607 is output	B

B ▶ REPLACE ECM

A ▶ **END**

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DTC	P060A	Internal Control Module Monitoring Processor Performance

MONITOR DESCRIPTION

The main CPU and sub CPU of the ECM communicate with each other. The main CPU monitors the communications and WDC pulses from the sub CPU. When the signal malfunctions below deviate, the DTC is stored.

DTC No.	DTC Detection Condition	Trouble Area
P060A	ECM sub CPU error	ECM

MONITOR STRATEGY

Related DTCs	P060A: ECM CPU error
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	-
Frequency of operation	Continuous
Duration	Within 1 second
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

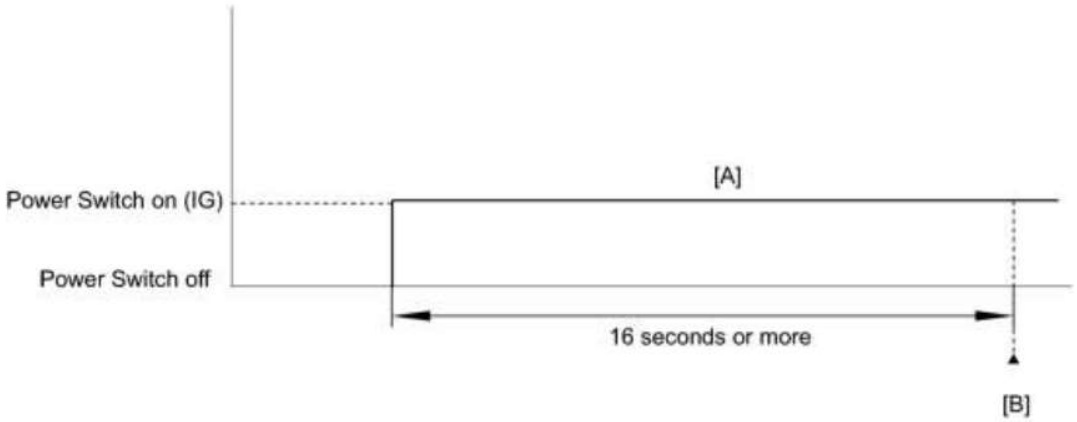
Monitor runs whenever following DTCs are not present	None

TYPICAL MALFUNCTION THRESHOLDS

Either of the following conditions is met	Condition 1 or 2
1. All of the following conditions are met	Condition (a), (b) and (c)
(a) CPU reset	1 time or more
(b) Leaned throttle position	2.6 V or more
(c) Electronic throttle actuator	OFF
2. CPU reset	2 times or more
Either of the following conditions is met	Condition 3 or 4
3. DMA communication error	Detected
4. Watching from Monitoring Processor not toggle	0.88 seconds or more

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on.
6. Wait 16 seconds or more [A].
7. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
8. Read the DTC [B].
9. If a DTC is output, the system is malfunctioning.

   HINT:

   If a DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P060A.
12. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment

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Techstream Display	Description
	○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [A] again.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

15. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	READ OUTPUT DTC (DTC P060A)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTC INFO.

(e) Turn the power switch off and turn the Techstream off.

(f) Disconnect the Techstream.

(g) Disconnect the cable from the battery negative (-) terminal and wait for 1 minute.

(h) Connect the cable to the battery negative (-) terminal.

(i) Connect the Techstream to the DLC3.

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(j) Turn the power switch on (IG).

(k) Wait 16 seconds or more.

(l) Turn the Techstream on.

(m) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(n) Read the DTCs.

Result:

Result	Proceed to
DTC is not output	A
DTC P060A is output	B

B ▶ REPLACE ECM

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

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DTC	P060B	Internal Control Module A/D Processing Performance

DESCRIPTION

This DTC is output when a communication error occurs in the ECM.

DTC No.	DTC Detection Condition	Trouble Area
P060B	ECM main CPU communication error	ECM

MONITOR STRATEGY

Related DTCs	P060B: ECM main CPU communication error
Required sensors/components (Main)	ECM
Required sensors/components (Related)	-
Frequency of operation	Continuous
Duration	2 times: AD converter 30 times: Knock control circuit
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

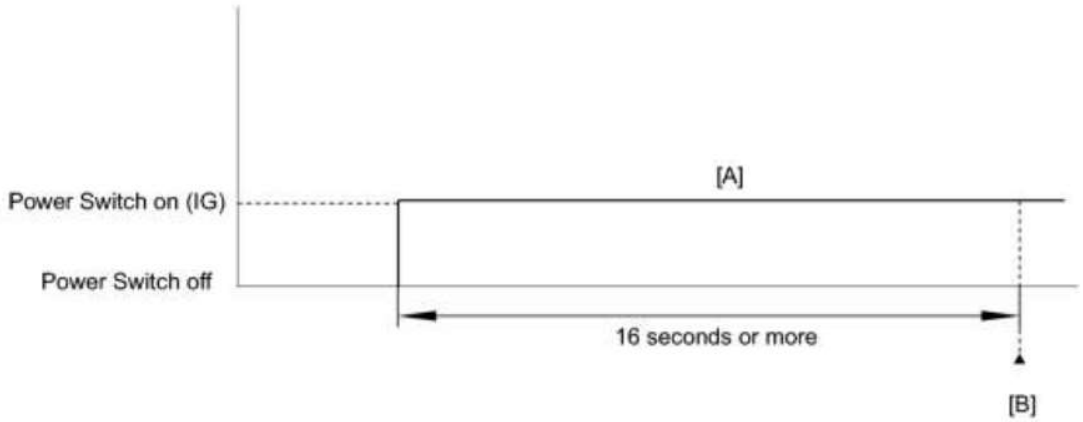
Monitor runs whenever following DTCs are not present	None

TYPICAL MALFUNCTION THRESHOLDS

One of the following conditions is met:	(a) or (b)
(a) AD converter	Fail
(b) Knock sensor circuit	Fail

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on.
6. Wait 16 seconds or more [A].
7. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
8. Read the DTC [B].
9. If a DTC is output, the system is malfunctioning.

   HINT:

   If a DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P060B.
12. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment

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Techstream Display	Description
	○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [A] again.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

15. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	READ OUTPUT DTC (DTC P060B)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Turn the power switch off.

(f) Turn the Techstream off.

(g) Disconnect the Techstream.

(h) Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.

(i) Connect the cable to the negative (-) battery terminal.

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(j) Connect the Techstream to the DLC3.

(k) Turn the power switch on (IG).

(l) Wait 16 seconds or more.

(m) Turn the Techstream on.

(n) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(o) Read the DTCs.

Result:

Result	Proceed to
DTC is not output	A
DTC P060B is output	B
DTC P060B and P0327 or P0328 are output	C

C ▶ GO TO DTC (P0327 AND P0328)
B ▶ REPLACE ECM
A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

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DTC	P060E	Internal Control Module Throttle Position Performance

MONITOR DESCRIPTION

The ECM monitors the input signals of the No. 1 throttle position sensor. When the ECM monitors the input signal of the No. 1 throttle position sensor, if the input signal and control signal deviate, the DTC is stored.

DTC No.	DTC Detection Condition	Trouble Area
P060E	ECM main CPU error	ECM

MONITOR STRATEGY

Related DTCs	P060E: Internal control module, Throttle position
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	-
Frequency of operation	Continuous
Duration	1 second
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

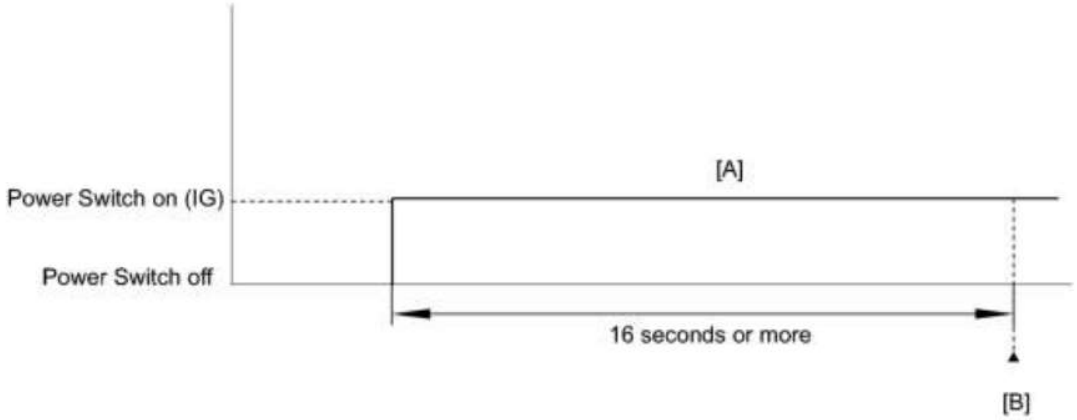
Monitor runs whenever the following DTCs are not present	None
DMA communication error	Not detected

TYPICAL MALFUNCTION THRESHOLDS

Difference of main throttle position and sub throttle position	0.3 V or more

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on.
6. Wait 16 seconds or more [A].
7. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
8. Read the DTC [B].
9. If a DTC is output, the system is malfunctioning.

   HINT:

   If a DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P060E.
12. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment

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Techstream Display	Description
	○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [A] again.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

15. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	READ OUTPUT DTC (DTC P060E)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Turn the power switch off and turn the Techstream off.

(f) Disconnect the Techstream.

(g) Disconnect the cable from the battery negative (-) terminal and wait for 1 minute.

(h) Connect the cable to the battery negative (-) terminal.

(i) Connect the Techstream to the DLC3.

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(j) Turn the power switch on (IG).

(k) Wait 16 seconds or more.

(l) Turn the Techstream on.

(m) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(n) Read the DTCs.

Result:

Result	Proceed to
DTC is not output	A
DTC P060E is output	B

B ▶ REPLACE ECM

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

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DTC	P062F	Internal Control Module EEPROM Error

DESCRIPTION

The ECM monitors its internal operation and stores this DTC when it detects an internal malfunction.

DTC No.	DTC Detection Condition	Trouble Area
P062F	An ECM internal error (EEPROM)	ECM

MONITOR DESCRIPTION

The ECM monitors its internal operation. If the internal operation is malfunctioning, the ECM illuminates the MIL and stores a DTC.

MONITOR STRATEGY

Related DTCs	P062F: Internal control module EEPROM error
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	-
Frequency of operation	Once per driving cycle
Duration	11 seconds
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

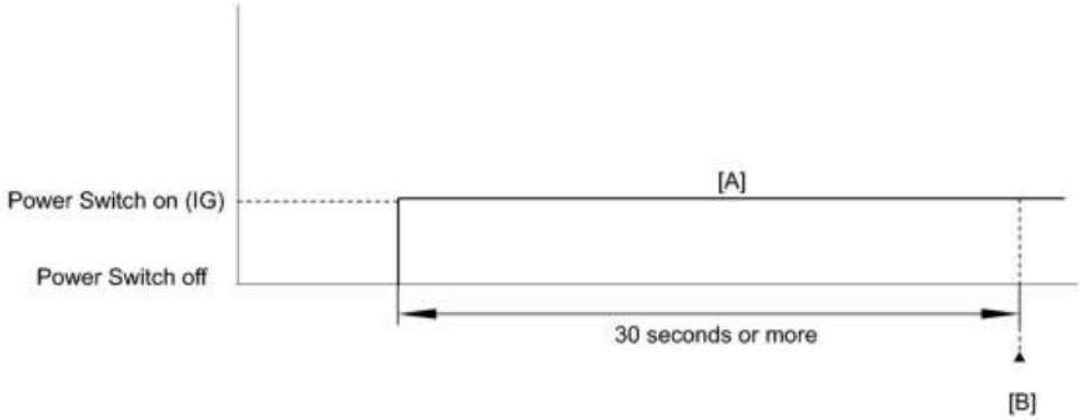
Monitor runs whenever following DTCs are not present	None
Time after engine start	10 seconds or more
Battery voltage	8 V or more
Power switch	On (IG)

TYPICAL MALFUNCTION THRESHOLDS

Permanent fault code data	Mismatch (3 times or more)

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on.
6. Wait 30 seconds or more [A].
7. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
8. Read the DTC [B].
9. If a DTC is output, the system is malfunctioning.

   HINT:

   If a DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P062F.
12. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment

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Techstream Display	Description
	○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [A] again.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

15. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	READ OUTPUT DTC (DTC P062F)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Turn the power switch off and turn the Techstream off.

(f) Disconnect the Techstream.

(g) Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.

(h) Connect the cable to the negative (-) battery terminal.

(i) Connect the Techstream to the DLC3.

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(j) Turn the power switch on (IG).

(k) Wait 30 seconds or more.

(l) Turn the Techstream on.

(m) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(n) Read the DTCs.

Result

Result	Proceed to
DTC is not output	A
DTC P062F is output	B

B ▶ REPLACE ECM

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

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DTC	P0657	Actuator Supply Voltage Circuit / Open

MONITOR DESCRIPTION

The ECM monitors the output voltage to the throttle actuator. This self-check ensures that the ECM is functioning properly. The output voltage is usually 0 V when the power switch is turned off. If the output voltage is higher than 7 V when the power switch is turned off, the ECM will illuminate the MIL and set the DTC the next time the power switch is turned on (IG).

DTC No.	DTC Detection Condition	Trouble Area
P0657	Throttle actuator power supply error	ECM

MONITOR STRATEGY

Related DTCs	P0657: Electronic throttle control system power supply
Required sensors/Components (Main)	ECM
Required sensors/Components (Related)	Throttle actuator
Frequency of operation	Once per driving cycle
Duration	1 second
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

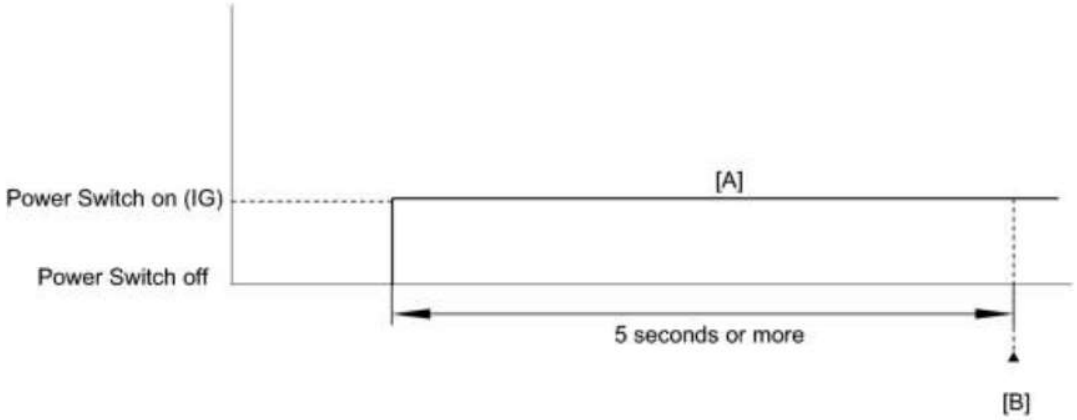
Monitor runs whenever following DTCs are not present	None
Throttle actuator power supply voltage	7 V or more

TYPICAL MALFUNCTION THRESHOLDS

Power switch	On (IG) to off
Electric throttle actuator power supply	ON

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and turn the Techstream off.
5. Wait for 30 seconds.
6. Turn the power switch on (IG) and turn the Techstream on.
7. Wait 5 seconds or more [A].
8. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
9. Read the DTC [B].
10. If a DTC is output, the system is malfunctioning.

HINT:

If a DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
12. Input the DTC: P0657.
13. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions

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Techstream Display	Description
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [A] again.

14. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

16. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	READ OUTPUT DTC (DTC P0657)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Turn the power switch off and turn the Techstream off.

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(f) Disconnect the Techstream.

(g) Disconnect the cable from the battery negative (-) terminal and wait for 1 minute.

(h) Connect the cable to the battery negative (-) terminal.

(i) Turn the power switch on (IG) for 10 seconds.

(j) Turn the power switch off.

(k) Connect the Techstream to the DLC3.

(l) Turn the power switch on (IG).

(m) Wait 5 seconds or more.

(n) Turn the Techstream on.

(o) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(p) Read the DTCs.

Result:

Result	Proceed to
DTC is not output	A
DTC P0657 is output	B

B ▶ REPLACE ECM

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

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DTC	P106A	Evaporative Emission System Pressure Sensor - Manifold Absolute Pressure Correlation

DESCRIPTION

DTC No.	DTC Detection Condition	Trouble Area
P106A	The difference between the pressure of the canister pressure sensor (Vapor Pressure Pump*) and manifold absolute pressure sensor (MAP*) is 7 kPa (52.50 mmHg) or more (2 trip detection logic)	• Canister pressure sensor (canister assembly) • Manifold absolute pressure sensor

HINT:

*: Data List Name

MONITOR DESCRIPTION

Tis DTC is designed to detect a deviation in the output characteristics of a pressure sensor.

The pressure of the canister pressure sensor and manifold absolute pressure sensor is monitored 55 minutes after the power switch is turned off. If there is a difference in the pressures, the MIL is illuminated (2 trip detection logic).

HINT:

Correct judgment may not be possible when the altitude is 13124 ft (4000 m) or more.

MONITOR STRATEGY

Related DTC	P106A: Absolute pressure sensor rationality
Required sensors/Components (Main)	Canister pressure sensor Manifold absolute pressure sensor
Required sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	Within 65 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	P0106, P0107, P0108 (Manifold Absolute Pressure)

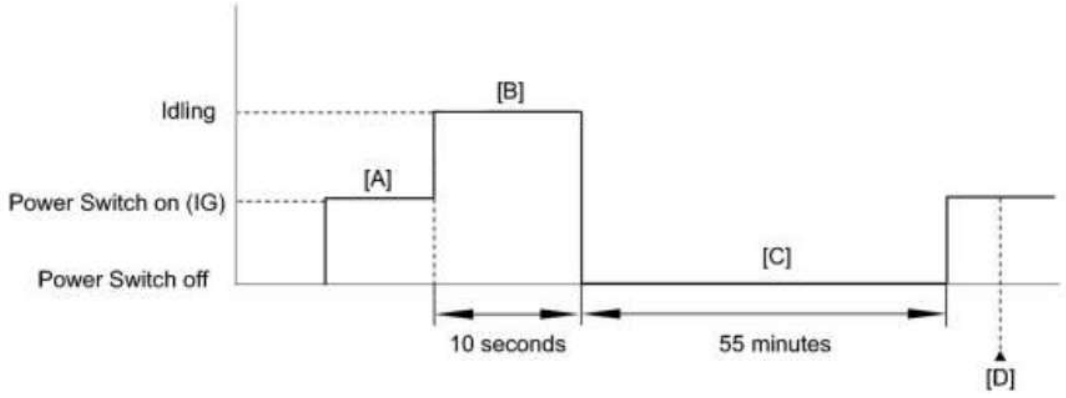
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	P0401 (EGR System (Closed)) P0452, P0453 (Evaporative Emission System Pressure Sensor)
Arrive at after engine stop	50 minutes
Time after ECM started by soak-timer	60 seconds or more
Battery voltage	10.5 V or more
Intake air temperature	-10°C (14°F) or more
Engine coolant temperature sensor	-10°C (14°F) or more

TYPICAL MALFUNCTION THRESHOLDS

Difference between EVAP pressure and manifold absolute pressure	7.442 kPa (55.83 mmHg) or more

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the Clear DTC procedure) INFO [A].
4. Put the engine in inspection mode INFO.
5. Start the engine and Idle for 10 seconds [B]
6. Turn the power switch off and wait for 30 seconds.
7. Leave the power switch off for 55 minutes [C]
8. Connect the Techstream to the DLC3.
9. Turn the power switch on (IG) and turn the Techstream on.
10. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
11. Read the pending DTC [D].
12. If a pending DTC is output, the system is malfunctioning.

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HINT:

If a pending DTC is not output, perform the following procedure.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Input the DTC: P106A.
15. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [B] through [C].

16. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
17. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

18. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

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Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO P106A)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result

Result	Proceed to
DTC P106A is output	A
DTC P106A and other DTCs are output	B

HINT:

If any DTCs other than P106A are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	READ VALUE USING TECHSTREAM (VAPOR PRESSURE PUMP AND MAP)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / Vapor Pressure Pump and MAP.

(e) Compare the Vapor Pressure Pump and MAP data from the Data List with day's atmospheric pressure*.

HINT:

- *: Standard atmospheric pressure is 101 kPa (760 mmHg) at sea level. The atmospheric pressure decreases by approximately 1 kPa (7.5 mmHg) for every 100 m of elevation increase. Atmospheric

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pressure is also affected by weather conditions. The Atmosphere pressure listed in the Data List cannot be used as a reference for this check.

- If you do not know the atmospheric pressure refer to the Vapor Pressure Pump value of other vehicles in the workshop and check the difference in pressure.

Result

Result	Proceed to
If the Vapor Pressure Pump value differs from the atmospheric pressure by +/- 3.5 kPa (+/- 26.25 mmHg) or more	A
If the MAP value differs from the atmospheric pressure by +/- 3.5 kPa (+/- 26.25 mmHg) or more	B

B ▶ REPLACE MANIFOLD ABSOLUTE PRESSURE SENSOR

A ▼

3.	REPLACE CANISTER

(a) Replace the canister INFO.

NEXT ▶ CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

4.	REPLACE MANIFOLD ABSOLUTE PRESSURE SENSOR

(a) Replace the manifold absolute pressure sensor INFO.

NEXT ▼

5.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG) and the Techstream on.

(c) Enter the following menus: Powertrain / Engine and ECT / Data List / MAP and Vapor Pressure Pump.

(d) Confirm that the difference between Vapor Pressure Pump and MAP are 3.5 kPa (+/- 26.25 mmHg) or less.

NEXT ▶ **END**

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DTC	P2102	Throttle Actuator Control Motor Circuit Low
DTC	P2103	Throttle Actuator Control Motor Circuit High

DESCRIPTION

The throttle actuator is operated by the ECM and opens and closes the throttle valve using gears.

The opening angle of the throttle valve is detected by the throttle position sensor, which is mounted on the throttle body assembly. The throttle position sensor provides feedback to the ECM. This feedback allows the ECM to appropriately control the throttle actuator and monitor the throttle opening angle as the ECM responds to driver inputs.

HINT:

This electronic throttle control system does not use a throttle cable.

DTC No.	DTC Detection Condition	Trouble Area
P2102	Both of the following conditions continue for 2 seconds (1 trip detection logic): (a) Throttle actuator duty ratio is 80% or more (b) Throttle actuator current is below 0.5 A	• Open in throttle actuator circuit • Throttle actuator • ECM
P2103	Either condition is met (1 trip detection logic): • Hybrid IC diagnosis signal fails • Hybrid IC current limiter port fails	• Short in throttle actuator circuit • Throttle actuator • Throttle valve • Throttle body assembly • ECM

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MONITOR DESCRIPTION

The ECM monitors the electrical current through the electronic actuator, and detects malfunctions and open circuits in the throttle actuator based on this value. If the current is outside the standard range, the ECM determines that there is a malfunction in the throttle actuator. In addition, if the throttle valve does not function properly (for example, stuck on), the ECM determines that there is a malfunction. The ECM then illuminates the MIL and stores a DTC.

Example:

- When the electrical current is below 0.5 A and the throttle actuator duty ratio exceeds 80%, the ECM interprets this as the current being outside the standard range, illuminates the MIL and stores a DTC.
- If the malfunction is not repaired successfully, a DTC is stored when the engine is quickly revved to a high engine speed several times after the engine has idled for 5 seconds after engine start.

MONITOR STRATEGY

Related DTCs	P2102: Throttle actuator current (low current) P2103: Throttle actuator current (high current)
Required Sensors / Components (Main)	Throttle actuator (throttle body assembly)
Required Sensors / Components (Related)	None
Frequency of Operation	Continuous
Duration	P2102: 2 seconds P2103: 25 times
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not present	None

P2102

Throttle actuator	ON
Duty-cycle ratio to open throttle actuator	80% or more
Throttle actuator power supply	8 V or higher
Motor current change during latest 0.016 seconds	Less than 0.2 A

P2103

Throttle actuator	ON
Either of the following conditions 1 or 2 is met:	-
1. Throttle actuator power supply	8 V or higher
2. Throttle actuator power	ON

TYPICAL MALFUNCTION THRESHOLDS

P2102

Throttle actuator current	Below 0.5 A

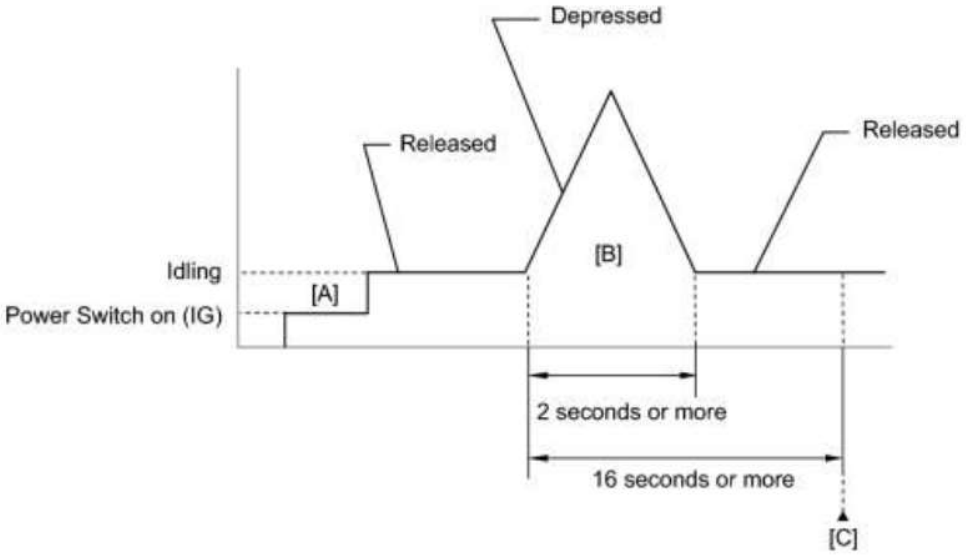
P2103

Either of the following conditions is met:	Condition 1 or 2

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1. Hybrid IC diagnosis signal	Fail
2. Hybrid IC current limiter monitor port	Fail

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine.
8. With the vehicle stationary, fully depress the accelerator pedal and quickly release it [B].
9. Check that 16 seconds or more have elapsed from the instant when the accelerator pedal is first depressed.
10. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
11. Read the DTC [C].
12. If a DTC is output, the system is malfunctioning.

    HINT:

    If a DTC is not output, perform the following procedure.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Input the DTC: P2102 or P2103.
15. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed

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Techstream Display	Description
	○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform step [B] again.

16. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
17. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

18. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

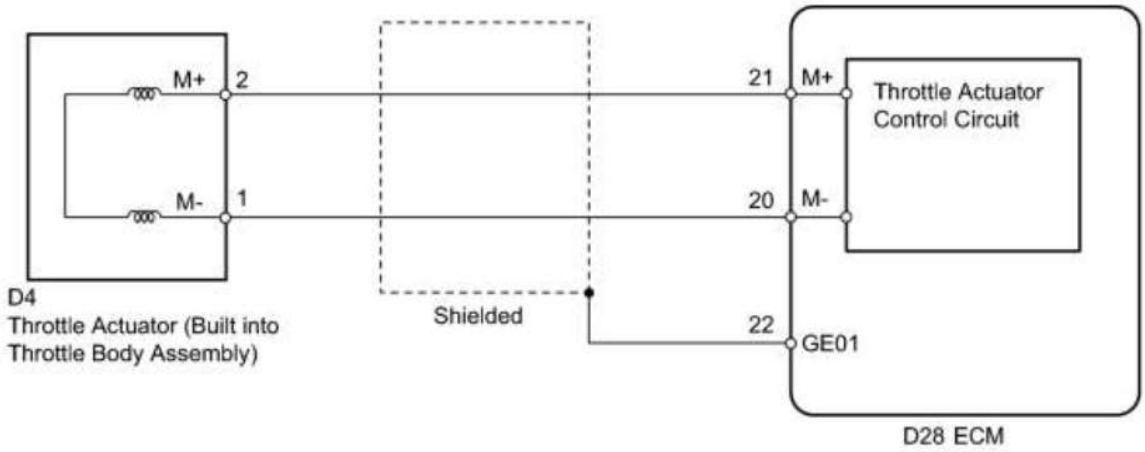
FAIL-SAFE

When either of these DTCs, as well as other DTCs relating to electronic throttle control system malfunctions is stored, the ECM enters fail-safe mode. During fail-safe mode, the ECM cuts the current to the throttle actuator, and the throttle valve is returned to a 5.5° throttle angle by the return spring. The ECM stops the engine and the vehicle can be driven using solely the hybrid system. If the accelerator pedal is depressed firmly and gently, the vehicle can be driven slowly.

Fail-safe mode continues until a pass condition is detected, and the power switch is then turned off.

WIRING DIAGRAM

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INSPECTION PROCEDURE

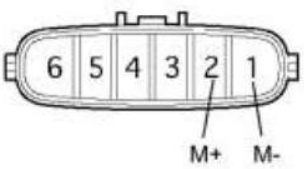
HINT:

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- The throttle actuator current (Throttle Motor Current) and the throttle actuator duty ratio (Throttle Motor Duty (Open) / Throttle Motor Duty (Close)) can be read using the Techstream. However, the ECM shuts off the throttle actuator current when the electronic throttle control system malfunctions.

PROCEDURE

1.	INSPECT THROTTLE BODY ASSEMBLY (RESISTANCE OF THROTTLE ACTUATOR)

*1



(a) Disconnect the throttle body assembly connector.

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(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
2 (M+) - 1 (M-)	20°C (68°F)	0.3 to 100 Ω

Text in Illustration

*1	Component without harness connected (Throttle Body Assembly)

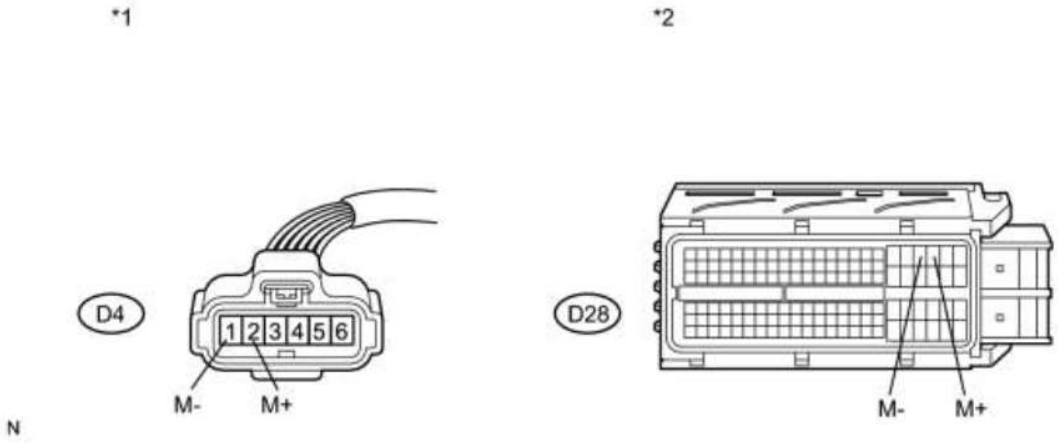
(c) Reconnect the throttle body assembly connector.

NG ▶ REPLACE THROTTLE BODY ASSEMBLY

OK ▼

2.	CHECK HARNESS AND CONNECTOR (THROTTLE BODY ASSEMBLY - ECM)

(a) Disconnect the throttle body assembly connector.



(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D4-2 (M+) - D28-21 (M+)	Always	Below 1 Ω
D4-1 (M-) - D28-20 (M-)	Always	Below 1 Ω

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Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D4-2 (M+) or D28-21 (M+) - Body ground	Always	10 kΩ or higher
D4-1 (M-) or D28-20 (M-) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Throttle Body Assembly)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the ECM connector.

(e) Reconnect the throttle body assembly connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (THROTTLE BODY ASSEMBLY - ECM)
OK
▼

3.	INSPECT THROTTLE BODY ASSEMBLY (VISUALLY CHECK THROTTLE VALVE)

(a) Check for foreign objects between the throttle valve and the housing.

OK:

No foreign objects between throttle valve and housing.

NG ▶ REMOVE FOREIGN OBJECT AND CLEAN THROTTLE BODY ASSEMBLY
OK
▼

4.	INSPECT THROTTLE BODY ASSEMBLY (THROTTLE VALVE)

(a) Check if the throttle valve opens and closes smoothly.

OK:

Throttle valve opens and closes smoothly.

NG ▶ REPLACE THROTTLE BODY ASSEMBLY
OK ▶ **REPLACE ECM**

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DTC	P2111	Throttle Actuator Control System - Stuck Open
DTC	P2112	Throttle Actuator Control System - Stuck Closed

DESCRIPTION

The throttle actuator is operated by the ECM, and opens and closes the throttle valve using gears. The opening angle of the throttle valve is detected by the throttle position sensor, which is mounted on the throttle body assembly. The throttle position sensor provides feedback to the ECM. This feedback allows the ECM to appropriately control the throttle actuator and monitor the throttle opening angle as the ECM responds to driver inputs.

HINT:

This electronic throttle control system does not use a throttle cable.

DTC No.	DTC Detection Condition	Trouble Area
P2111	The ECM signals the throttle actuator to close, but the actuator is stuck (1 trip detection logic)	• Throttle actuator • Throttle body assembly • Throttle valve • ECM
P2112	The ECM signals the throttle actuator to open, but the actuator is stuck (1 trip detection logic)	• Throttle actuator • Throttle body assembly • Throttle valve • ECM

MONITOR DESCRIPTION

The ECM determines that there is a malfunction in the electronic throttle control system when the throttle valve remains at the fixed angle despite a high drive current from the ECM. The ECM illuminates the MIL and stores a DTC.

If the malfunction is not repaired successfully, a DTC is stored when the accelerator pedal is fully depressed and released quickly (to fully open and close the throttle valve) after the engine is next started.

MONITOR STRATEGY

Related DTCs	P2111: Throttle actuator stuck open P2112: Throttle actuator stuck closed
Required Sensors / Components (Main)	Throttle actuator (throttle body assembly)
Required Sensors / Components (Related)	-
Frequency of Operation	Continuous
Duration	0.5 seconds

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MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not present	None

P2111 (Throttle Actuator Stuck Open)

All of the following conditions are met:	-
System guard* judge condition	ON
Throttle actuator current	2 A or more
Duty-cycle to close throttle	80% or more

P2112 (Throttle Actuator Stuck Closed)

All of the following conditions are met:	-
System guard* judge condition	ON
Throttle actuator current	2 A or more
Duty-cycle to open throttle	80% or more

*: System guard is ON when the following conditions set:	-
Throttle actuator	ON
Throttle actuator duty calculation	Executing
Throttle position sensor fail	Not detected
Throttle actuator current-cut operation	Not executing
Throttle actuator power supply	4 V or more
Throttle actuator fail	Not detected

TYPICAL MALFUNCTION THRESHOLDS

P2111 (Throttle Actuator Stuck Open)

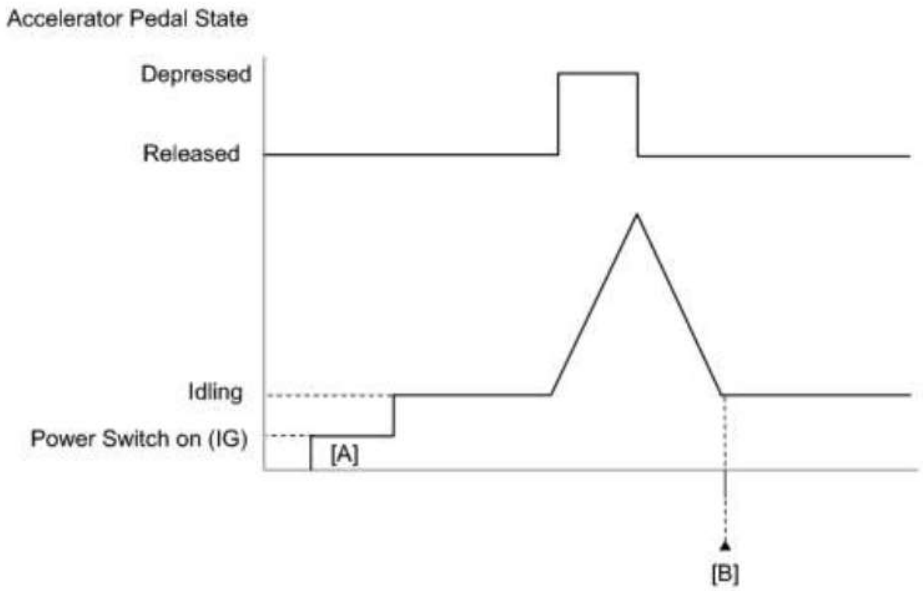
Throttle position sensor voltage change	No change

P2112 (Throttle Actuator Stuck Closed)

Throttle position sensor voltage change	No change

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine and fully depress and release the accelerator pedal quickly (to fully open and close the throttle valve).
8. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
9. Read the DTC [B].
10. If a DTC is output, the system is malfunctioning.

    HINT:

    If a DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
12. Input the DTC: P2111 or P2112.
13. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed

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Techstream Display	Description
	○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, fully depress and release the accelerator pedal quickly.

14. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

16. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

FAIL-SAFE

When either of these DTCs, as well as other DTCs relating to electronic throttle control system malfunctions is stored, the ECM enters fail-safe mode. During fail-safe mode, the ECM cuts the current to the throttle actuator, and the throttle valve is returned to a 5.5° throttle angle by the return spring. The ECM stops the engine and the vehicle can be driven using solely the hybrid system. If the accelerator pedal is depressed firmly and gently, the vehicle can be driven slowly.

Fail-safe mode continues until a pass condition is detected, and the power switch is then turned off.

WIRING DIAGRAM

Refer to DTC P2102 INFO.

INSPECTION PROCEDURE

HINT:

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Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	INSPECT THROTTLE BODY ASSEMBLY (VISUALLY CHECK THROTTLE VALVE)

(a) Check for contamination between the throttle valve and the housing. If necessary, clean the throttle body assembly. And check that the throttle valve moves smoothly.

OK:

Throttle valve is not contaminated with foreign objects and moves smoothly.

NG ▶ REPLACE THROTTLE BODY ASSEMBLY

OK ▼

2.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2111 OR P2112)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Put the engine in inspection mode INFO.

(f) Start the engine, and fully depress and release the accelerator pedal quickly (to fully open and close the throttle valve).

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Read the DTCs.

Result:

Result	Proceed to
DTC is not output	A
DTC P2111 or P2112 is output	B

B ▶ REPLACE ECM

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

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DTC	P2118	Throttle Actuator Control Motor Current Range / Performance

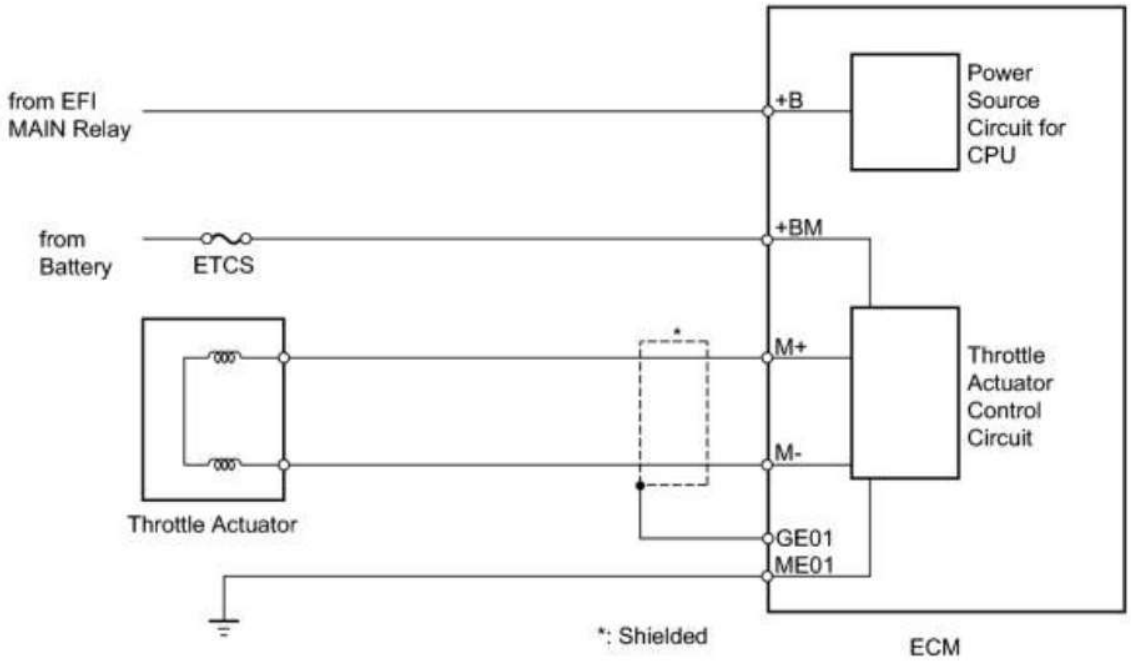
DESCRIPTION

The electronic throttle control system has a dedicated power supply circuit. The voltage (+BM) is monitored and when it is low (below 4 V), the ECM determines that there is a malfunction in the electronic throttle control system and cuts off the current to the throttle actuator.

When the voltage becomes unstable, the electronic throttle control system itself becomes unstable. For this reason, when the voltage is low, the current to the throttle actuator is cut. If repairs are made and the system returns to normal, turn the power switch off. The ECM then allows the current to flow to the throttle actuator so that it can be restarted.

HINT:

This electronic throttle control system does not use a throttle cable.



Y

DTC No.	DTC Detection Condition	Trouble Area
P2118	An open in electronic throttle control system power source (+BM) circuit (1 trip detection logic)	• Open in electronic throttle control system power source circuit • Battery • Battery terminals • ETCS fuse • ECM

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MONITOR DESCRIPTION

The ECM monitors the battery supply voltage applied to the throttle actuator.

When the power supply voltage (+BM) drops below 4 V for 0.8 seconds or more, the ECM interprets this as an open in the power supply circuit (+BM). The ECM illuminates the MIL and stores the DTC.

If the malfunction is not repaired successfully, the DTC is stored 5 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P2118: Throttle actuator power supply
Required Sensors / Components (Main)	Throttle actuator, throttle valve (throttle body assembly), ETCS fuse
Required Sensors / Components (Related)	None
Frequency of Operation	Continuous
Duration	0.8 seconds
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
Battery voltage	8 V or higher
Electronic throttle actuator power	ON

TYPICAL MALFUNCTION THRESHOLDS

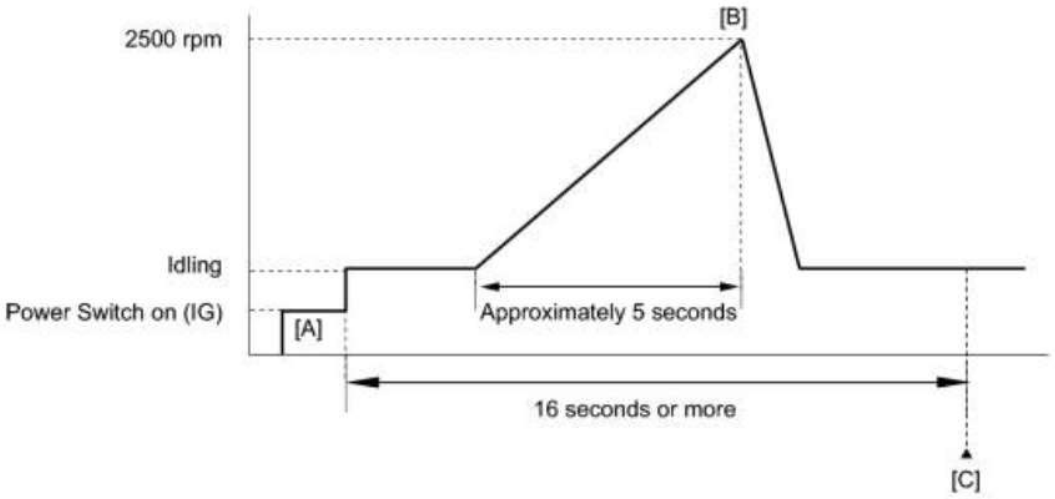
Throttle actuator power supply voltage (+BM)	Below 4 V

COMPONENT OPERATING RANGE

Throttle actuator power supply voltage (+BM)	11 to 14 V

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine.
8. Slowly depress the accelerator pedal, raise the engine speed to approximately 2500 rpm for approximately 5 seconds, and then idle the engine [B].
9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
10. Read the DTC [C].
11. If a DTC is output, the system is malfunctioning.

    HINT:

    If a DTC is not output, perform the following procedure.

12. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
13. Input the DTC: P2118.
14. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal

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Techstream Display	Description
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [B] again.

15. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
16. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

17. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

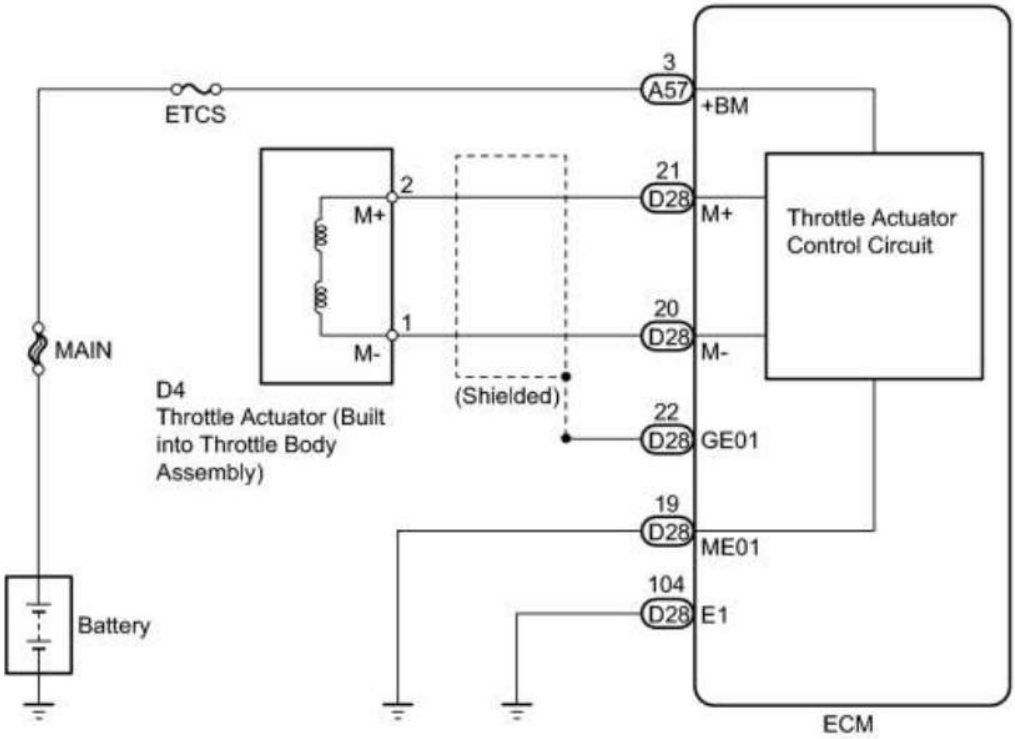
- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

FAIL-SAFE

When this DTC or other DTCs relating to electronic throttle control system malfunctions, are stored, the ECM enters fail-safe mode. During fail-safe mode, the ECM cuts the current to the throttle actuator, and the throttle valve is returned to a 5.5° throttle angle by the return spring. The ECM stops the engine and the vehicle can be driven using solely the hybrid system. If the accelerator pedal is depressed firmly and gently, the vehicle can be driven slowly. Fail-safe mode continues until a pass condition is detected, and the power switch is then turned off.

WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	READ VALUE USING TECHSTREAM (+BM VOLTAGE)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

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(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Data List / +BM voltage.

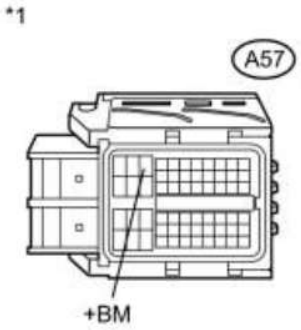
(e) Read the value displayed on the Techstream.

Standard Voltage:

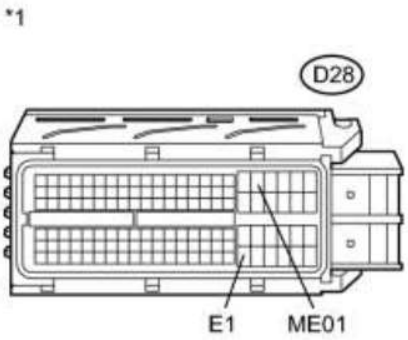
11 to 14 V

NG ▶ CHECK HARNESS AND CONNECTOR (ECM - BATTERY, BODY GROUND)
OK ▶ **CHECK FOR INTERMITTENT PROBLEMS**

2.	CHECK HARNESS AND CONNECTOR (ECM - BATTERY, BODY GROUND)



(a) Disconnect the ECM connectors.



(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Condition	Specified Condition
A57-3 (+BM) - Body ground	Always	11 to 14 V

Text in Illustration

*1	Front view of wire harness connector (to ECM)

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(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D28-19 (ME01) - Body ground	Always	Below 1 Ω
D28-104 (E1) - Body ground	Always	Below 1 Ω

(d) Reconnect the ECM connectors.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - BATTERY, BODY GROUND)
OK ▶ **REPLACE ECM**

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DTC	P2119	Throttle Actuator Control Throttle Body Range / Performance

DESCRIPTION

The electronic throttle control system is composed of the throttle actuator, throttle position sensor, accelerator pedal position sensor, and ECM. The ECM operates the throttle actuator to regulate the throttle valve in response to driver inputs. The throttle position sensor detects the opening angle of the throttle valve, and provides the ECM with feedback so that the throttle valve can be appropriately controlled by the ECM.

DTC No.	DTC Detection Condition	Trouble Area
P2119	Throttle valve opening angle continues to vary greatly from the target opening angle (1 trip detection logic)	• Electronic throttle control system • ECM

MONITOR DESCRIPTION

The ECM determines the actual opening angle of the throttle valve from the throttle position sensor signal. The actual opening angle is compared to the target opening angle commanded by the ECM. If the difference between these 2 values is outside the standard range, the ECM interprets this as a malfunction in the electronic throttle control system. The ECM then illuminates the MIL and stores the DTC.

If the malfunction is not repaired successfully, the DTC is stored when the accelerator pedal is quickly released (to close the throttle valve) after the engine speed reaches 5000 rpm by depressing the accelerator pedal (fully open the throttle valve).

MONITOR STRATEGY

Related DTCs	P2119: Electronic throttle control system malfunction
Required Sensors / Components (Main)	Throttle actuator (throttle body assembly)
Required Sensors / Components (Related)	-
Frequency of Operation	Continuous
Duration	1 second
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
System guard* judge condition	ON
*System guard is ON when the following conditions set	-
Throttle actuator	ON
Throttle actuator duty calculation	Executing

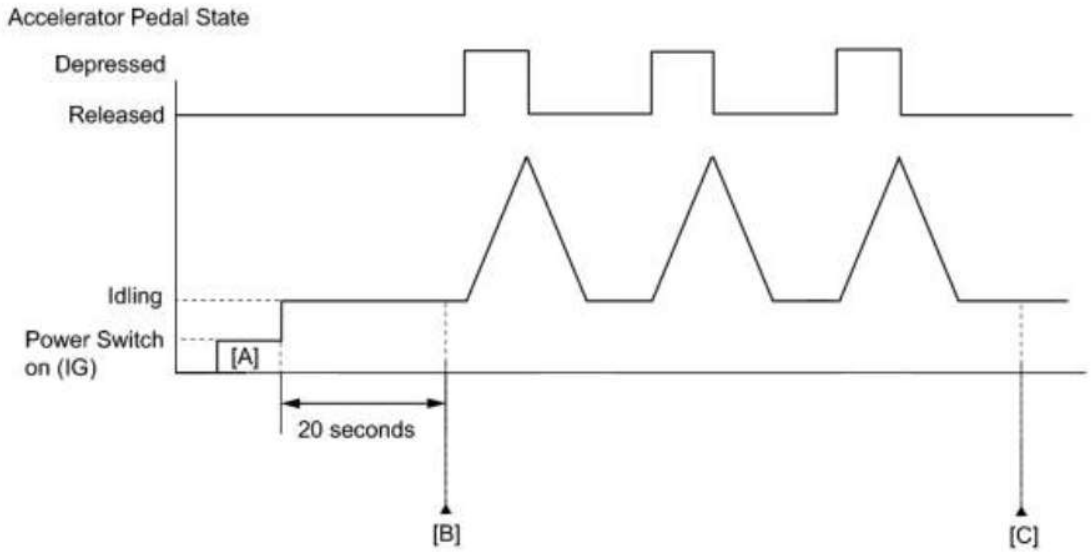
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Throttle position sensor fail	Not detected
Throttle actuator current-cut operation	Not executing
Throttle actuator power supply	4 V or more
Throttle actuator fail	Not detected

TYPICAL MALFUNCTION THRESHOLDS

Either of the following conditions A or B is met	-
A. Commanded closed throttle position - current closed throttle position	0.3 V or higher for 1 second
B. Commanded open throttle position - current open throttle position	0.3 V or higher for 0.6 seconds

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine.
8. Idle the engine for 20 seconds.
9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
10. Read the DTC [B].
11. If a DTC is output, the system is malfunctioning.

HINT:

If a DTC is not output, perform the following procedure.

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12. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
13. Input the DTC: P2119.
14. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, fully depress and release the accelerator pedal 3 times.

15. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
16. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

17. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

FAIL-SAFE

When this DTC, as well as other DTCs relating to electronic throttle control system malfunctions is stored, the ECM enters fail-safe mode. During fail-safe mode, the ECM cuts the current to the throttle actuator, and the throttle valve is returned to a 5.5° throttle angle by the return spring. The ECM stops the engine and the vehicle can be driven using solely the hybrid system. If the accelerator pedal is depressed firmly and gently, the vehicle can be driven slowly. Fail-safe mode continues until a pass condition is detected, and the power switch is then turned off.

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WIRING DIAGRAM

Refer to DTC P2102 INFO.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P2119)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result:

Result	Proceed to
DTC P2119 is output	A
DTC P2119 and other DTCs are output	B

HINT:

If any DTCs other than P2119 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

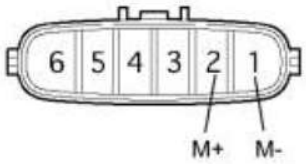
A ▼

2.	INSPECT THROTTLE BODY ASSEMBLY (RESISTANCE OF THROTTLE ACTUATOR)

(a) Disconnect the throttle body assembly connector.

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*1



(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
2 (M+) - 1 (M-)	20°C (68°F)	0.3 to 100 Ω

Text in Illustration

*1	Component without harness connected (Throttle Body Assembly)

(c) Reconnect the throttle body assembly connector.

NG ▶ REPLACE THROTTLE BODY ASSEMBLY

OK ▼

3.	REPLACE ECM

(a) Replace the ECM INFO.

NEXT ▼

4.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2119)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

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(e) Put the engine in inspection mode INFO.

(f) Allow the engine to idle for 20 seconds or more.

(g) Fully depress and release the accelerator pedal 3 times quickly.

(h) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(i) Read the DTCs.

HINT:

The output voltage of the throttle position sensor can be checked using the Techstream. Variations in the output voltage indicate that the throttle actuator is in operation. To check the output voltage using the Techstream, enter the following menus: Powertrain / Engine and ECT / Data List / Throttle Position No. 1.

Result:

Result	Proceed to
DTC is not output	A
DTC P2119 is output	B

B ▶ REPLACE THROTTLE BODY ASSEMBLY

A ▶ **END**

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DTC	P2195	Oxygen (A/F) Sensor Signal Stuck Lean (Bank 1 Sensor 1)
DTC	P2196	Oxygen (A/F) Sensor Signal Stuck Rich (Bank 1 Sensor 1)

DESCRIPTION

HINT:

- Although the DTC titles say oxygen sensor, these DTCs relate to the air fuel ratio sensor.
- Sensor 1 refers to the sensor mounted in front of the three-way catalytic converter and located near the engine assembly.

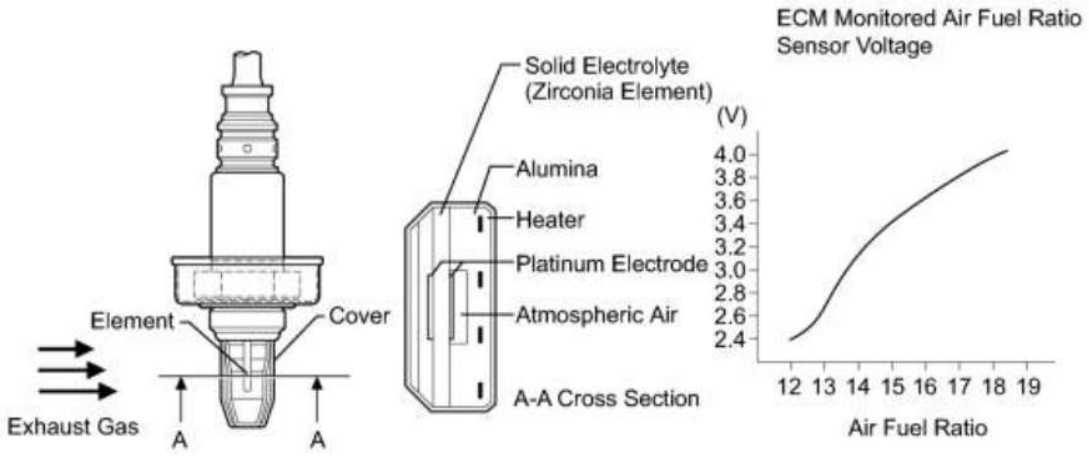
The air fuel ratio sensor generates a voltage* that corresponds to the actual air fuel ratio. This sensor voltage is used to provide the ECM with feedback so that it can control the air fuel ratio. The ECM determines the deviation from the stoichiometric air fuel ratio level, and regulates the fuel injection time. If the air fuel ratio sensor malfunctions, the ECM is unable to control the air fuel ratio accurately.

The air fuel ratio sensor is the planar type and is integrated with the heater, which heats the solid electrolyte (zirconia element). This heater is controlled by the ECM. When the intake air volume is low (the exhaust gas temperature is low), a current flows into the heater to heat the sensor, in order to facilitate accurate oxygen concentration detection. In addition, the sensor and heater portions are the narrow type. The heat generated by the heater is conducted to the solid electrolyte through the alumina, therefore the sensor activation is accelerated.

In order to obtain a high purification rate of the carbon monoxide (CO), hydrocarbons (HC) and nitrogen oxide (NOx) components in the exhaust gas, a three-way catalytic converter is used. For the most efficient use of the three-way catalytic converter, the air fuel ratio must be precisely controlled so that it is always close to the stoichiometric level.

*: Value changes inside the ECM. Since the air fuel ratio sensor is a current output element, the current is converted into a voltage inside the ECM. Any measurements taken at the air fuel ratio sensor or ECM connectors will show a constant voltage.

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DTC No.	DTC Detection Condition	Trouble Area
P2195	Conditions (a) and (b) continue for 5 seconds or more (2 trip detection logic) • (a) Air fuel ratio sensor voltage more than 3.8 V • (b) Heated oxygen sensor voltage rises from less than 0.21 V to 0.59 V or more	• Open or short in air fuel ratio sensor (sensor 1) circuit • Air fuel ratio sensor (sensor 1) • Air fuel ratio sensor (sensor 1) heater • Air fuel ratio sensor heater circuit • Intake system • Fuel pressure • Fuel injector assembly • EGR valve assembly • ECM
	While fuel-cut operation performed (during vehicle deceleration), air fuel ratio sensor current is 3.6 mA or more for 3 seconds (2 trip detection logic)	• Air fuel ratio sensor (sensor 1) • EGR valve assembly • ECM
P2196	Conditions (a) and (b) continue for 5 seconds or more (2 trip detection logic) • (a) Air fuel ratio sensor voltage less than 2.8 V • (b) Heated oxygen sensor voltage falls from 0.59 V or more to less than 0.21 V	• Open or short in air fuel ratio sensor (sensor 1) circuit • Air fuel ratio sensor (sensor 1) • Air fuel ratio sensor (sensor 1) heater • Air fuel ratio sensor heater circuit • Intake system

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DTC No.	DTC Detection Condition	Trouble Area
		• Fuel pressure • Fuel injector assembly • EGR valve assembly • ECM
	While fuel-cut operation performed (during vehicle deceleration), air fuel ratio sensor current is less than 1.0 mA for 3 seconds (2 trip detection logic)	• Air fuel ratio sensor (sensor 1) • EGR valve assembly • ECM

HINT:

- When any of these DTCs are set, check the air fuel ratio sensor voltage output by entering the following menus on the Techstream: Powertrain / Engine and ECT / Data List / All Data / AFS Voltage B1S1.
- Short-term fuel trim values can also be read using the Techstream.
- The ECM regulates the voltages at the A1A+ and A1A- terminals of the ECM to a constant level. Therefore, the air fuel ratio sensor voltage output cannot be confirmed without using the Techstream.
- If an air fuel ratio sensor malfunction is detected, the ECM sets a DTC.

MONITOR DESCRIPTION

Sensor Voltage Detection Monitor

Under the air fuel ratio feedback control, if the air fuel ratio sensor voltage output indicates rich or lean for a certain period of time, the ECM determines that there is a malfunction in the air fuel ratio sensor. The ECM illuminates the MIL and stores a DTC.

Example:

If the air fuel ratio sensor voltage output is below 2.8 V (very rich condition) and heated oxygen sensor output voltage falls from 0.59 V or more to less than 0.21 V for 5 seconds, the ECM stores DTC P2196. Alternatively, if the air fuel ratio sensor voltage output is higher than 3.8 V (very lean condition) and heated oxygen sensor output voltage rises from less than 0.21 V to 0.59 V or more for 5 seconds, DTC P2195 is stored.

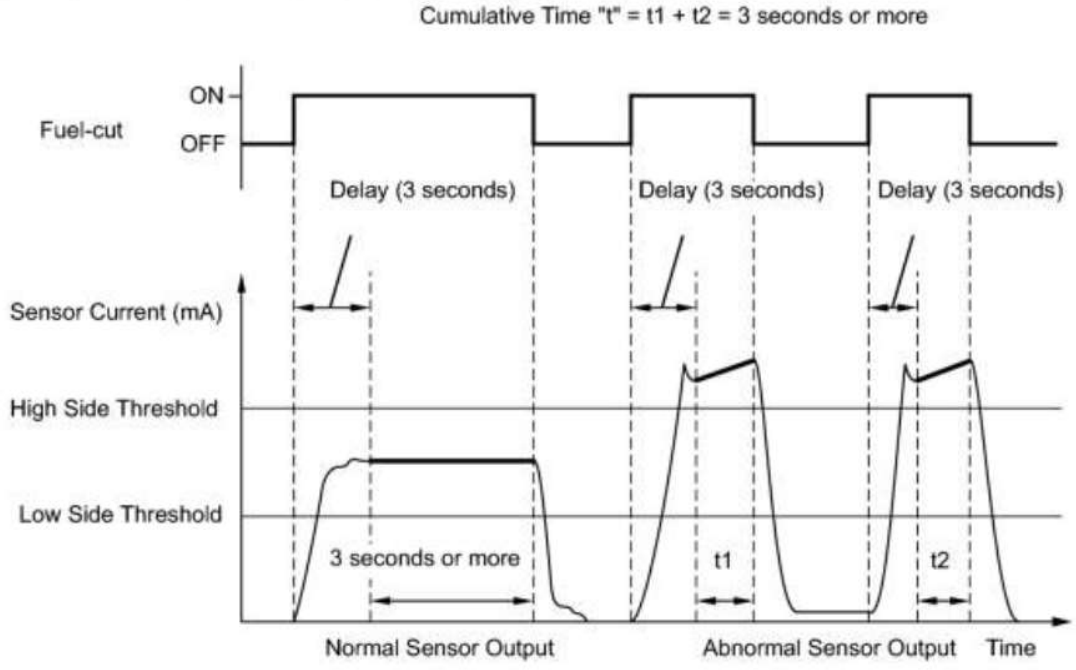
Sensor Current Detection Monitor

A rich air fuel mixture causes a low air fuel ratio sensor current, and a lean air fuel mixture causes a high air fuel ratio sensor current. Therefore, the sensor output becomes low during acceleration, and it becomes high during deceleration with the throttle valve fully closed. The ECM monitors the air fuel ratio sensor current during fuel-cut and detects any abnormal current values.

If the air fuel ratio sensor output is 3.6 mA or higher for more than 3 seconds of cumulative time, the ECM interprets this as a malfunction in the air fuel ratio sensor and stores DTC P2195 (stuck on high side). If the air fuel ratio sensor output is below 1.57 mA for more than 3 seconds of cumulative time, the ECM stores DTC P2196 (stuck on low side).

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Air Fuel Ratio Sensor Current Monitor



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MONITOR STRATEGY

Related DTCs	P2195: Air fuel ratio sensor (Bank 1) signal stuck lean P2196: Air fuel ratio sensor (Bank 1) signal stuck rich
Required Sensors/Components (Main)	Air fuel ratio sensor
Required Sensors/Components (Related)	Heated oxygen sensor
Frequency of Operation	Continuous
Duration	5 seconds: Sensor voltage detection monitor 3 seconds: Sensor current detection monitor
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

ALL

Monitor runs whenever following DTCs are not present	P0016 (VVT System Bank 1 - Misalignment) P0031, P0032, P101D (Air Fuel Ratio Sensor Heater - Sensor 1)

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	P0102, P0103 (Mass Air Flow Meter) P0107, P0108 (Manifold Absolute Pressure) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0128 (Thermostat) P0171, P0172 (Fuel System) P0301, P0302, P0303, P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0401 (EGR System (Closed)) P0451, P0452, P0453 (EVAP System) P0505 (Idle speed control)

Sensor Voltage Detection Monitor (Lean Side Malfunction P2195)

Time after engine start	30 seconds or more
Fuel system status	Closed-loop

Sensor Voltage Detection Monitor (Rich Side Malfunction P2196)

Time after engine start	30 seconds or more
Fuel system status	Closed-loop

Sensor Current Detection Monitor (P2195, P2196)

Battery voltage	11 V or more
Atmospheric pressure	76 kPa (570 mmHg) or higher
Air fuel ratio sensor status	Activated
Engine coolant temperature	75°C (167°F) or more
Continuous time of fuel cut	3 to 10 seconds
Delay time after EGR valve closed	2 seconds or more

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TYPICAL MALFUNCTION THRESHOLDS

Sensor Voltage Detection Monitor (Lean Side Malfunction P2195)

Heated oxygen sensor output voltage	Rises from less than 0.21 V to 0.59 V or more
Air fuel ratio sensor voltage	More than 3.8 V

Sensor Voltage Detection Monitor (Rich Side Malfunction P2196)

Heated oxygen sensor output voltage	Falls from 0.59 V or more to less than 0.21 V
Air fuel ratio sensor voltage	Less than 2.8 V

Sensor Current Detection Monitor (High Side Malfunction P2195)

Air fuel ratio sensor current	3.6 mA or more

Sensor Current Detection Monitor (Low Side Malfunction P2196)

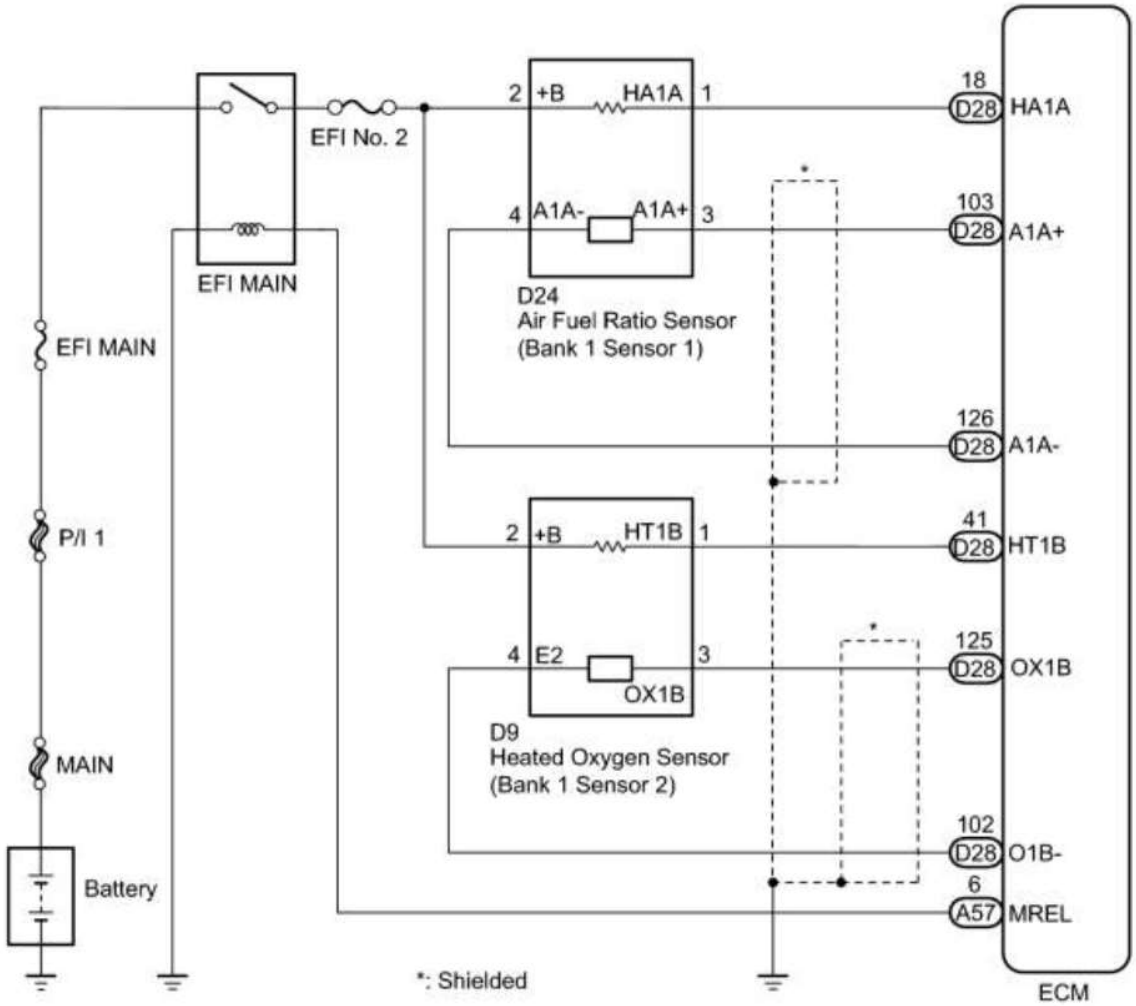
Air fuel ratio sensor current	Less than 1.57 mA

MONITOR RESULT

Refer to Checking Monitor Status INFO.

WIRING DIAGRAM

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CONFIRMATION DRIVING PATTERN

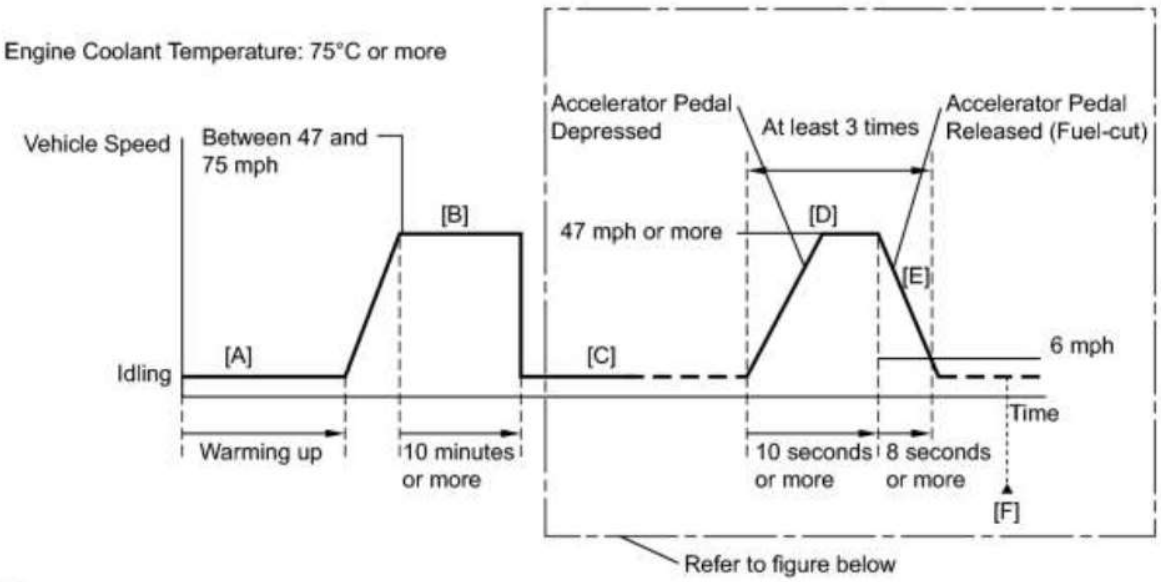
CAUTION:

Strictly observe posted speed limits, traffic laws, and road conditions when performing these drive patterns.

HINT:

This confirmation driving pattern is used in the "Perform Confirmation Driving Pattern" procedure of the following diagnostic troubleshooting procedure.

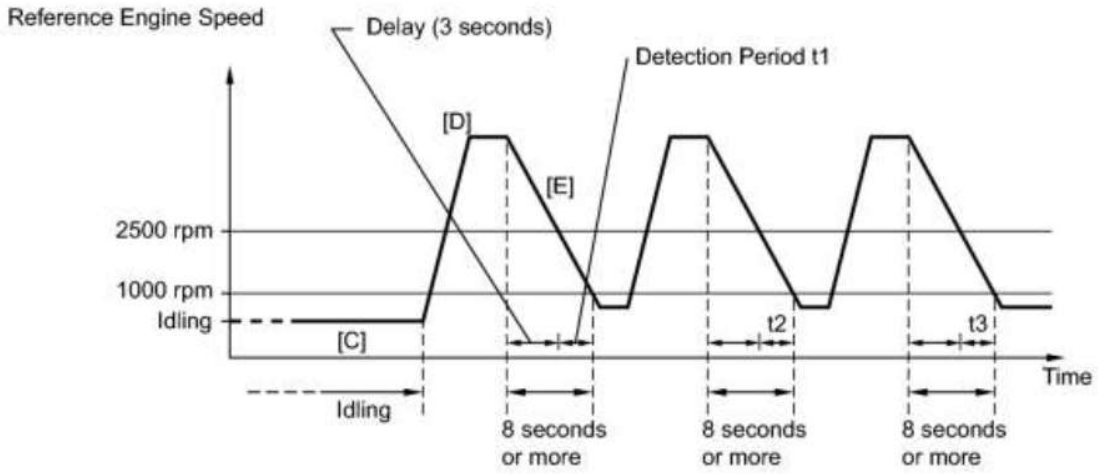
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N

Driving Pattern Detail for [C] through [F]:

Cumulative Detection Period "t" = t1 + t2 + t3 = 3 seconds or more



N

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG).
3. Turn the Techstream on.
4. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
5. Turn the power switch off and wait for 30 seconds.
6. Turn the power switch on (IG) and turn the Techstream on.
7. Put the engine in inspection mode INFO.
8. Start the engine, and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher [A].
9. On the Techstream, enter the following menus to check the fuel-cut status: Powertrain / Engine and ECT / Data List / All Data / Idle Fuel Cut.
10. Drive the vehicle at between 47 and 75 mph (75 and 120 km/h) for at least 10 minutes [B].

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CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

11. Move the shift lever in B [C].
12. Accelerate the vehicle to 47 mph (75 km/h) or more by depressing the accelerator pedal for at least 10 seconds [D].
13. Soon after performing step [D] above, release the accelerator pedal for at least 8 seconds without depressing the brake pedal in order to execute fuel-cut control [E].

HINT:

Fuel-cut is performed when the following conditions are met:

- Accelerator pedal is fully released.
- Engine speed is 2500 rpm or more (fuel injection returns at 1000 rpm).

14. Allow the vehicle to decelerate until the vehicle speed decreases to less than 6 mph (10 km/h).
15. Repeat steps [C] through [E] above at least 3 times in one driving cycle.
16. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
17. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
18. Read the pending DTC [F].
19. If a pending DTC is output, the system is malfunctioning.

HINT:

If a pending DTC is not output, perform the following procedure.

20. Input the DTC: P2195 or P2196.
21. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

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- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [B] through [E].

22. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
23. Check the judgment result.

    HINT:

    - If the judgment result shows ABNORMAL, the system has a malfunction.
    - If the judgment result shows NORMAL, the system is normal.

24. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

Malfunctioning areas can be identified by performing the Control the Injection Volume for A/F Sensor function provided in the Active Test. The Control the Injection Volume for A/F Sensor function can help to determine whether the air fuel ratio sensor, heated oxygen sensor and other potential trouble areas are malfunctioning.

The following instructions describe how to conduct the Control the Injection Volume for A/F Sensor operation using the Techstream.

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Put the engine in inspection mode INFO.
4. Start the engine.
5. Turn the Techstream on.
6. Warm up the engine at an engine speed of 2500 rpm for approximately 90 seconds.
7. Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor.
8. Perform the Active Test operation with the engine idling (press the RIGHT or LEFT button to change the fuel injection volume).
9. Monitor the output voltages of the air fuel ratio and heated oxygen sensors (AFS Voltage B1S1 and O2S B1S2) displayed on the Techstream.

HINT:

- The Control the Injection Volume for A/F Sensor operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.

- Each sensor reacts in accordance with increases in the fuel injection volume.

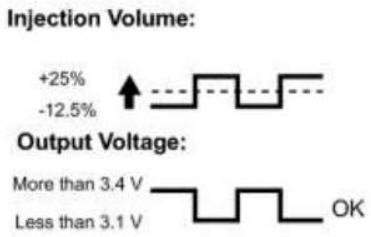
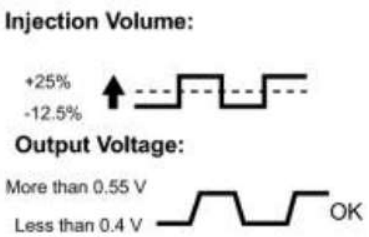
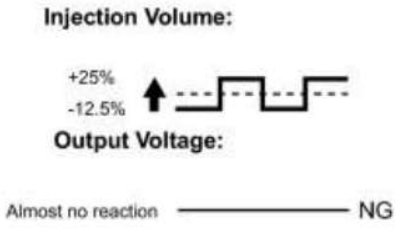
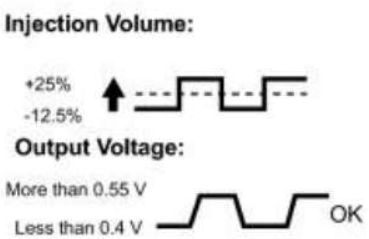
Techstream Display (Sensor)	Injection Volume	Status	Voltage

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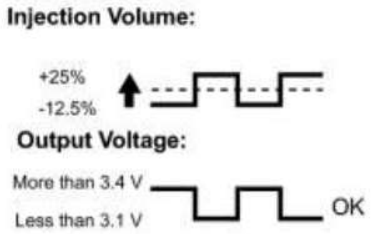
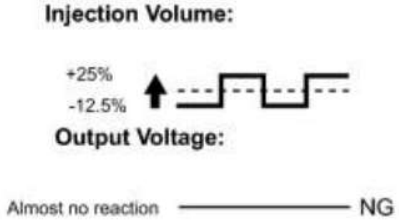
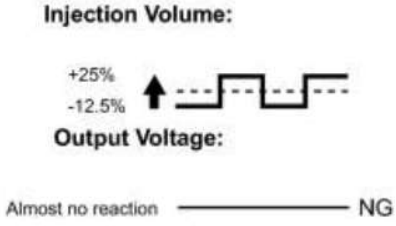
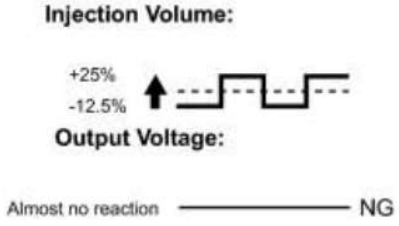
Techstream Display (Sensor)	Injection Volume	Status	Voltage
AFS Voltage B1S1 (Air fuel ratio)	+25%	Rich	Less than 3.1 V
AFS Voltage B1S1 (Air fuel ratio)	-12.5%	Lean	More than 3.4 V
O2S B1S2 (Heated oxygen)	+25%	Rich	More than 0.55 V
O2S B1S2 (Heated oxygen)	-12.5%	Lean	Less than 0.4 V

NOTICE:

The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

Case	Air Fuel Ratio Sensor (Sensor 1) Output Voltage	Heated Oxygen Sensor (Sensor 2) Output Voltage	Main Suspected Trouble Area
1			-
2			• Air fuel ratio sensor • Air fuel ratio sensor heater • Air fuel ratio sensor circuit
3			• Heated oxygen sensor • Heated oxygen sensor heater • Heated oxygen sensor circuit

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Case	Air Fuel Ratio Sensor (Sensor 1) Output Voltage	Heated Oxygen Sensor (Sensor 2) Output Voltage	Main Suspected Trouble Area
			• Exhaust gas leaks
4			• Fuel pressure • Exhaust gas leaks (Air fuel ratio extremely lean or rich)

- Following the Control the Injection Volume for A/F Sensor procedure enables technicians to check and graph the voltage outputs of both the air fuel ratio and heated oxygen sensors.
- To display the graph, enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor / A/F Control System / AFS Voltage B1S1 and O2S B1S2.

HINT:

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- A low air fuel ratio sensor voltage could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.
- A high air fuel ratio sensor voltage could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO P2195 OR P2196)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

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(e) Read the DTCs.

Result:

Result	Proceed to
DTC P2195 or P2196 is output	A
DTC P2195 or P2196 and other DTCs are output	B

HINT:

If any DTCs other than P2195 and P2196 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

(a) Has the vehicle run out of fuel in the past?

NO ▶ READ VALUE USING TECHSTREAM (TEST VALUE OF AIR FUEL RATIO SENSOR)

YES ▶ **DTC CAUSED BY RUNNING OUT OF FUEL**

3.	READ VALUE USING TECHSTREAM (TEST VALUE OF AIR FUEL RATIO SENSOR)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Put the engine in inspection mode INFO.

(f) Allow the vehicle to drive in accordance with the drive pattern described in the Confirmation Driving Pattern.

(g) Enter the following menus: Powertrain / Engine and ECT / Monitor / O2 Sensor / Status 2.

(h) Check that the Status 2 of O2 Sensor is Complete.

If the status is still Incomplete, perform the drive pattern increasing the vehicle speed and using the second gear to decelerate the vehicle.

(i) Enter the following menus: Powertrain / Engine and ECT / Monitor / O2 Sensor / Details / RANGE B1 S1.

(j) Check the test value of the air fuel ratio sensor output current during fuel-cut.

Result:

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Result	Proceed to
Within normal range (1.57 mA or higher, and below 3.6 mA)	A
Outside normal range (Below 1.57 mA, or 3.6 mA or higher)	B

B ▶ REPLACE AIR FUEL RATIO SENSOR

A ▼

4.	READ VALUE USING TECHSTREAM (OUTPUT VOLTAGE OF AIR FUEL RATIO SENSOR)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG) and turn the Techstream on.

(c) Put the engine in inspection mode INFO.

(d) Start the engine.

(e) Warm up the air fuel ratio sensor at an engine speed of 2500 rpm for 90 seconds.

(f) Enter the following menus: Powertrain / Engine and ECT / Data List / AFS Voltage B1S1 and Engine Speed, then press the Record button.

(g) Check the air fuel ratio sensor voltage 3 times, when the engine is in each of the following conditions:

- (1) While idling (check for at least 30 seconds) (Step "A").
- (2) At an engine speed of approximately 2500 rpm (without any sudden changes in engine speed) (Step "B").
- (3) The engine speed is raised to 2500 rpm and then the accelerator pedal is quickly released so that the throttle valve is fully closed (Step "C").

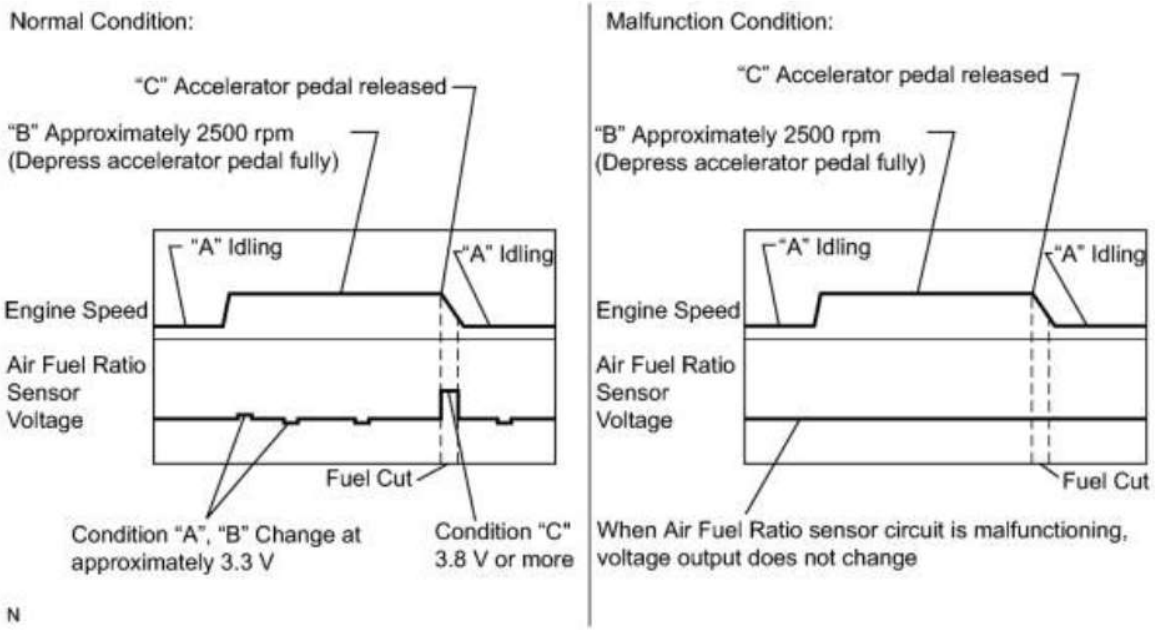
Standard Voltage:

Condition	Air Fuel Ratio Sensor Voltage Variation	Reference
Steps "A" and "B"	Changes at approximately 3.3 V	Between 3.1 V and 3.4 V
Step "C"	Increases to 3.8 V or higher	This occurs during engine deceleration (when fuel-cut performed)

HINT:

For more information, see the diagrams below.

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HINT:

- If the output voltage of the air fuel ratio sensor remains at approximately 3.3 V (see Malfunction Condition diagram) under any conditions, including those above, the air fuel ratio sensor may have an open circuit. (This will also happen if the air fuel ratio sensor heater has an open circuit.)
- If the output voltage of the air fuel ratio sensor remains at either approximately 3.8 V or higher, or below 2.8 V (see Malfunction Condition diagram) under any conditions, including those above, the air fuel ratio sensor may have a short circuit.
- The ECM stops fuel injection (fuel cut) during engine deceleration. This causes a lean condition and results in a momentary increase in the air fuel ratio sensor output voltage.
- When the vehicle is driven:

  The output voltage of the air fuel ratio sensor may be below 2.8 V during fuel enrichment. For the vehicle, this translates to a sudden increase in speed with the accelerator pedal fully depressed when trying to overtake another vehicle. The air fuel ratio sensor is functioning normally.

- The air fuel ratio sensor is a current output element; therefore, the current is converted into a voltage inside the ECM. Measuring the voltage at the connectors of the air fuel ratio sensor or ECM will show a constant voltage result.

NG ▶ INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)

OK ▼

5.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

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(d) Clear the DTCs.

(e) Put the engine in inspection mode INFO.

(f) Drive the vehicle referring to the Confirmation Driving Pattern.

NEXT

6.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2195 OR P2196)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(e) Read the Pending DTCs.

Result:

Result	Proceed to
DTC P2195 or P2196 is output	A
DTC is not output	B

B CHECK FOR INTERMITTENT PROBLEMS

A

7.	REPLACE AIR FUEL RATIO SENSOR

(a) Replace the air fuel ratio sensor INFO.

NEXT

8.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs.

(e) Put the engine in inspection mode INFO.

(f) Drive the vehicle referring to the Confirmation Driving Pattern.

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NEXT

9.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2195 OR P2196)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(e) Read the Pending DTCs.

Result:

Result	Proceed to
DTC P2195 or P2196 is output	A
DTC is not output	B

B END

A

10.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

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OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

Result:

Result	Proceed to
Outside of standard range	A
Within standard range	B

B ▶ REPLACE ECM

A ▼

11.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

NG ▶ REPLACE EGR VALVE ASSEMBLY

OK ▼

12.	REPLACE ECM

(a) Replace the ECM INFO.

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NEXT

13.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Turn the power switch off and wait for 30 seconds.

(f) Turn the power switch on (IG) and turn the Techstream on.

(g) Put the engine in inspection mode INFO.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(k) Input the DTC: P2195 or P2196.

(l) Check the DTC judgment result.

NEXT **END**

14.	INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE) INFO

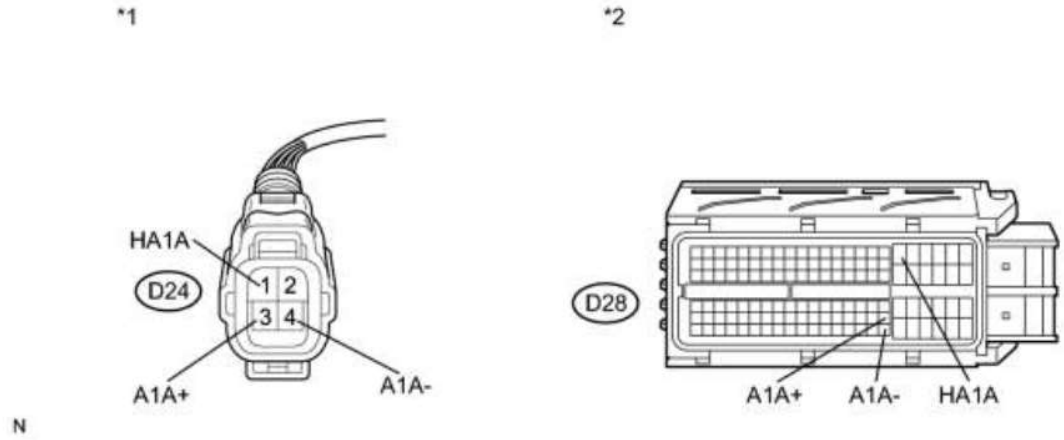
NG REPLACE AIR FUEL RATIO SENSOR

OK

15.	CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - ECM)

(a) Disconnect the air fuel ratio sensor connector.

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(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D24-1 (HA1A) - D28-18 (HA1A)	Always	Below 1 Ω
D24-3 (A1A+) - D28-103 (A1A+)		
D24-4 (A1A-) - D28-126 (A1A-)		

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D24-1 (HA1A) or D28-18 (HA1A) - Body ground	Always	10 kΩ or higher
D24-3 (A1A+) or D28-103 (A1A+) - Body ground		
D24-4 (A1A-) or D28-126 (A1A-) - Body ground		

Text in Illustration

*1	Front view of wire harness connector (to Air Fuel Ratio Sensor)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the air fuel ratio sensor connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (AIR FUEL RATIO SENSOR - ECM)
OK
▼

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16.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO.

OK:

No leaks from the intake system.

NG ▶ REPAIR OR REPLACE INTAKE SYSTEM

OK ▼

17.	CHECK FUEL PRESSURE

(a) Check the fuel pressure INFO.

NG ▶ REPAIR OR REPLACE FUEL SYSTEM

OK ▼

18.	INSPECT FUEL INJECTOR ASSEMBLY

(a) Check the fuel injector assembly injection (whether fuel volume is high or low, and whether injection pattern is poor) INFO.

NG ▶ REPLACE FUEL INJECTOR ASSEMBLY

OK ▼

19.	REPLACE AIR FUEL RATIO SENSOR

(a) Replace the air fuel ratio sensor INFO.

NEXT ▼

20.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs.

(e) Put the engine in inspection mode INFO.

(f) Drive the vehicle referring to the Confirmation Driving Pattern.

NEXT

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21.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2195 OR P2196)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(e) Read the Pending DTCs.

Result:

Result	Proceed to
DTC P2195 or P2196 is output	A
DTC is not output	B

B ▶ END

A

22.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

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MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

Result:

Result	Proceed to
Outside of standard range	A
Within standard range	B

B ▶ REPLACE ECM

A ▼

23.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

NG ▶ REPLACE EGR VALVE ASSEMBLY

OK ▼

24.	REPLACE ECM

(a) Replace the ECM INFO.

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NEXT

25.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Turn the power switch off and wait for 30 seconds.

(f) Turn the power switch on (IG) and turn the Techstream on.

(g) Put the engine in inspection mode INFO.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(k) Input the DTC: P2195 or P2196.

(l) Check the DTC judgment result.

NEXT **END**

26.	REPLACE AIR FUEL RATIO SENSOR

(a) Replace the air fuel ratio sensor INFO.

NEXT

27.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs.

(e) Put the engine in inspection mode INFO.

(f) Drive the vehicle referring to the Confirmation Driving Pattern.

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NEXT

28.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2195 OR P2196)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(e) Read the Pending DTCs.

Result:

Result	Proceed to
DTC is not output	A
DTC P2195 or P2196 is output	B

B REPLACE ECM

A **CHECK FOR INTERMITTENT PROBLEMS**

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DTC	P2237	Oxygen (A/F) Sensor Pumping Current Circuit / Open (Bank 1 Sensor 1)
DTC	P2238	Oxygen (A/F) Sensor Pumping Current Circuit Low (Bank 1 Sensor 1)
DTC	P2239	Oxygen (A/F) Sensor Pumping Current Circuit High (Bank 1 Sensor 1)
DTC	P2252	Oxygen (A/F) Sensor Reference Ground Circuit Low (Bank 1 Sensor 1)
DTC	P2253	Oxygen (A/F) Sensor Reference Ground Circuit High (Bank 1 Sensor 1)

DESCRIPTION

HINT:

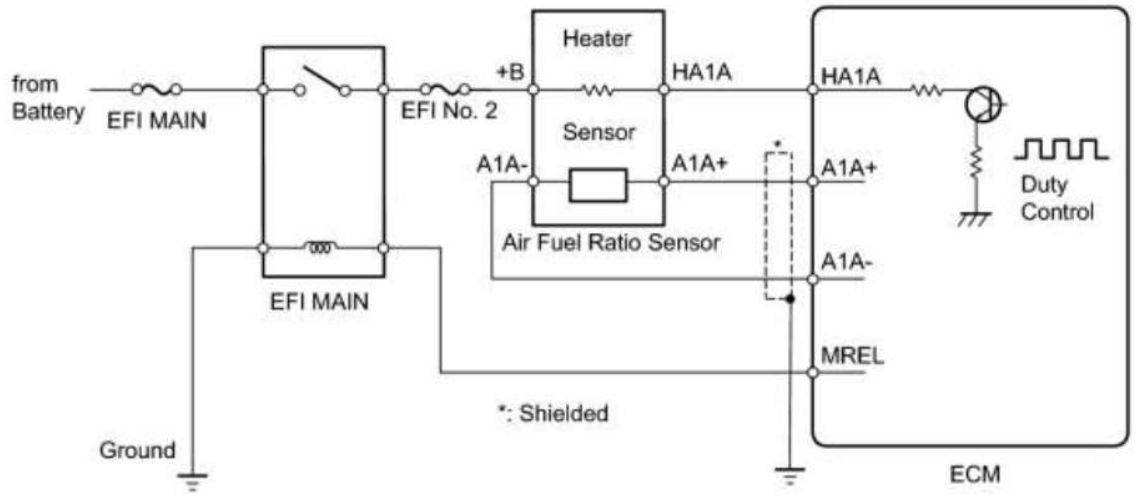
- Although the DTC titles say oxygen sensor, these DTCs relate to the air fuel ratio sensor.
- Sensor 1 refers to the sensor mounted in front of the three-way catalytic converter and located near the engine assembly.

The air fuel ratio sensor, which is located between the exhaust manifold and catalyst, consists of alloyed metal elements and a heater.

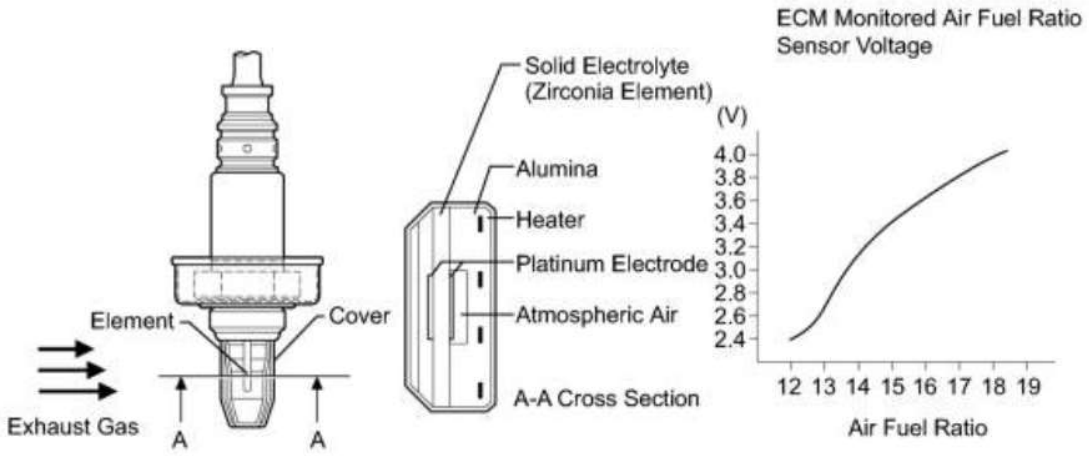
Depending on the engine operating conditions, the heater heats the sensor elements to activate them. Battery voltage is applied to the heater and the sensor ground is controlled by the ECM using a duty ratio.

The sensor elements convert the oxygen concentration in the exhaust gas into voltage values to output. Based on the voltage, the ECM determines the air fuel ratio and regulates the fuel injection volume depending on the air fuel ratio and engine operating conditions. The voltage changes between 0.6 V and 4.5 V while the engine is running. If the air fuel ratio is lean, which means the oxygen concentration in the exhaust gas is high, the voltage is high. If the air fuel ratio is rich, which means the oxygen concentration in the exhaust gas is low, the voltage is low.

Reference (System Diagram of Sensor 1):



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c

DTC No.	DTC Detection Condition	Trouble Area
P2237	Open in the circuit between terminals A1A+ and A1A- of the air fuel ratio sensor while engine is running (2 trip detection logic)	• Open in air fuel ratio sensor (sensor 1) circuit • Air fuel ratio sensor (sensor 1) • ECM
P2238	Any of the following conditions are met (2 trip detection logic) • Air fuel ratio sensor output drops while engine is running. • Voltage at terminal A1A+ voltage is 0.5 V or less. • Voltage difference between terminals A1A+ and A1A- voltage is 0.1 V or less.	• Open or short in air fuel ratio sensor (sensor 1) circuit • Air fuel ratio sensor (sensor 1) • ECM
P2239	A1A+ voltage is more than 4.5 V (2 trip detection logic)	• Open or short in air fuel ratio sensor (sensor 1) circuit • Air fuel ratio sensor (sensor 1) • ECM
P2252	A1A- voltage is 0.5 V or less (2 trip detection logic)	• Open or short in air fuel ratio sensor (sensor 1) circuit • Air fuel ratio sensor (sensor 1) • ECM
P2253	A1A- voltage is more than 4.5 V	• Open or short in air fuel ratio sensor (sensor 1) circuit

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DTC No.	DTC Detection Condition	Trouble Area
	(2 trip detection logic)	• Air fuel ratio sensor (sensor 1) • ECM

MONITOR DESCRIPTION

These DTCs are output when there is an open or short in the air fuel ratio sensor circuit, or if air fuel ratio sensor output drops. To detect these problems, the voltage of the air fuel ratio sensor is monitored when turning the power switch on (IG), and the admittance (admittance is an electrical term that indicates the ease of flow of current) is checked while driving. If the voltage of the air fuel ratio sensor is between 0.5 V and 4.5 V, it is considered normal. If the voltage is out of the specified range, or the admittance is less than the standard value, the ECM will determine that there is a malfunction in the air fuel ratio sensor. If the same malfunction is detected in next driving cycle, the MIL will be illuminated and a DTC will be stored.

MONITOR STRATEGY

Related DTCs	P2237: Air fuel ratio sensor open circuit between A1A+ and A1A- P2238: Air fuel ratio sensor short circuit between A1A+ and A1A- P2238: Air fuel ratio sensor short circuit between A1A+ and GND P2238: Air fuel ratio sensor low impedance P2239: Air fuel ratio sensor short circuit between A1A+ and +B P2252: Air fuel ratio sensor short circuit between A1A- and GND P2253: Air fuel ratio sensor short circuit between A1A- and +B
Required Sensors/Components (Main)	Air fuel ratio sensor
Required Sensors/Components (Related)	Engine coolant temperature sensor Crankshaft position sensor
Frequency of Operation	Continuous
Duration	10 seconds: P2237 (Air fuel ratio sensor open circuit between A1A+ and A1A-), P2238 (Air fuel ratio sensor low impedance) 5 seconds: Others
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

P2237 and P2238

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Monitor runs whenever following DTCs are not present	P0016 (VVT System Bank 1 - Misalignment) P0031, P0032, P101D (Air Fuel Ratio Sensor Heater - Sensor 1) P0102, P0103 (Mass Air Flow Meter) P0107, P0108 (Manifold Absolute Pressure) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0128 (Thermostat) P0171, P0172 (Fuel System) P0301, P0302, P0303, P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0401 (EGR System (Closed)) P0451, P0452, P0453 (EVAP System) P0505 (Idle speed control)

Other

Monitor runs whenever following DTCs are not present	None

P2237 (Air Fuel Ratio Sensor Open Circuit Between A1A+ and A1A-)

Estimated sensor temperature	450 to 550°C (842 to 1022°F)
Engine	Running
Battery voltage	11 V or more

P2238 (Air Fuel Ratio Sensor Low Impedance)

Estimated sensor temperature	700 to 800 °C (1292 to 1472°F)
Engine coolant temperature	10°C (50°F) or higher
Fuel cut	No executed

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Other

Battery voltage	11 V or more
Power switch	On (IG)
Time after power switch is off to on (IG)	5 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

P2237 (Air Fuel Ratio Sensor Open Circuit Between A1A+ and A1A-)

Air fuel ratio sensor admittance	Below 0.002 1/Ω

P2238 (Air Fuel Ratio Sensor Low Impedance)

Air fuel ratio sensor admittance	Below 0.022 1/Ω

P2238 (Air Fuel Ratio Sensor Short Circuit Between A1A+ and GND)

A1A+ terminal voltage	0.5 V or less

P2239 (Air Fuel Ratio Sensor Short Circuit Between A1A+ and +B)

A1A+ terminal voltage	More than 4.5 V

P2252 (Air Fuel Ratio Sensor Short Circuit Between A1A- and GND)

A1A- terminal voltage	0.5 V or less

P2253 (Air Fuel Ratio Sensor Short Circuit Between A1A- and +B)

A1A- terminal voltage	More than 4.5 V

P2238 (Air Fuel Ratio Sensor Short Circuit Between A1A+ and A1A-)

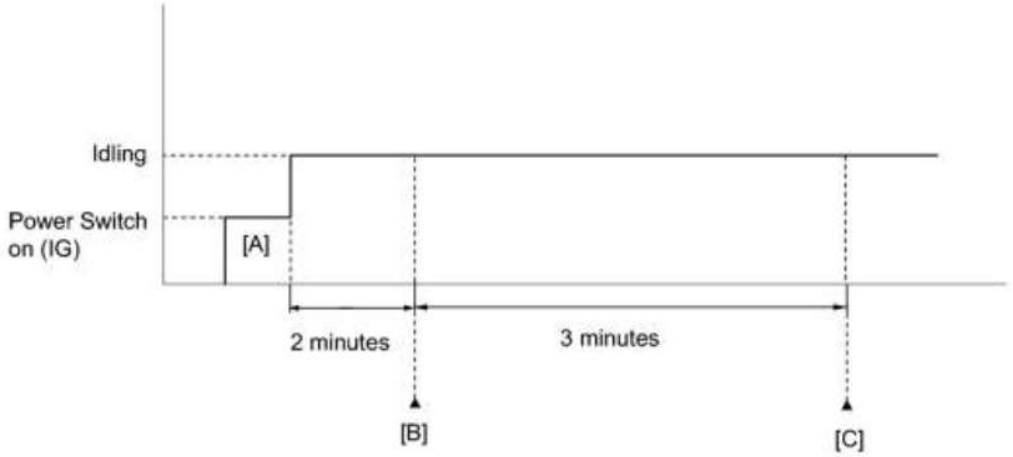
Difference between A1A+ terminal and A1A- terminal voltage	0.1 V or less

COMPONENT OPERATING RANGE

Air fuel ratio sensor admittance	0.002 1/Ω or more
A1A+ terminal voltage	0.5 to 4.5 V
A1A- terminal voltage	0.5 to 4.5 V
Difference between A1A+ and A1A- terminal voltages	0.1 to 0.8 V

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CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine and wait 2 minutes.
8. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
9. Read the pending DTC [B].
10. If a pending DTC is output, the system is malfunctioning.

    HINT:

    If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
12. Input the DTC: P2237, P2238, P2239, P2252 or P2253.
13. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed

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Techstream Display	Description
	○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, idle the engine for 3 minutes.

14. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
15. Check the judgment result [C].

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

16. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P2195 INFO.

INSPECTION PROCEDURE

HINT:

Malfunctioning areas can be identified by performing the Control the Injection Volume for A/F Sensor in the Active Test. The Control the Injection Volume for A/F Sensor function can help to determine whether the air fuel ratio sensor, heated oxygen sensor and other potential trouble areas are malfunctioning.

The following instructions describe how to conduct the Control the Injection Volume for A/F Sensor operation using the Techstream.

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Put the engine in inspection mode INFO.
4. Start the engine.
5. Warm up the engine at 2500 rpm for approximately 90 seconds.

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6. Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor.
7. Perform Active Test operation with the engine idling (press the RIGHT or LEFT button to change the fuel injection volume).
8. Monitor the output voltages of the air fuel ratio and heated oxygen sensors (AFS Voltage B1S1 and O2S B1S2) displayed on the Techstream.

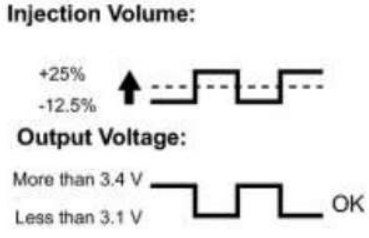
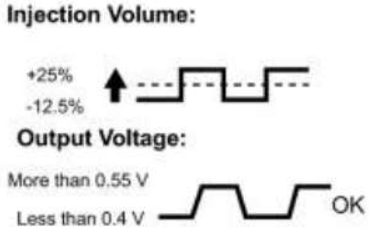
HINT:

- The Control the Injection Volume for A/F Sensor operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

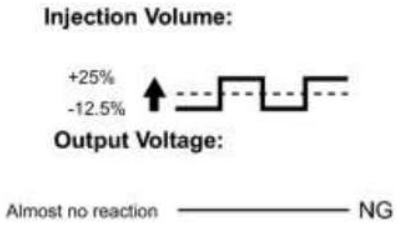
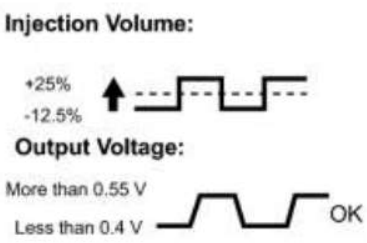
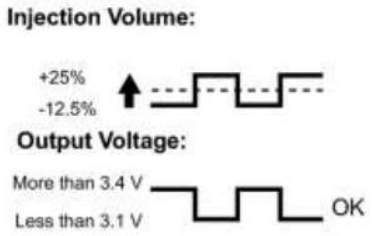
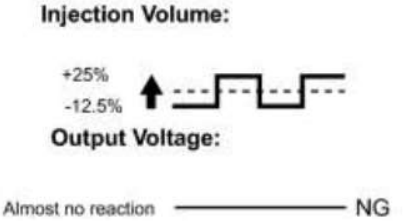
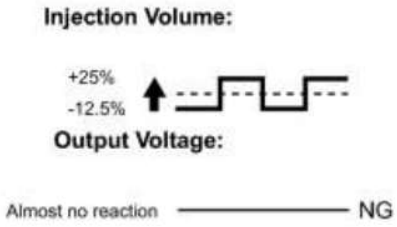
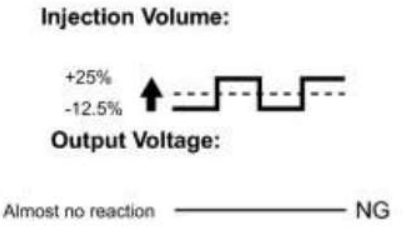
Techstream Display (Sensor)	Injection Volume	Status	Voltage
AFS Voltage B1S1 (Air fuel ratio)	+25%	Rich	Less than 3.1 V
AFS Voltage B1S1 (Air fuel ratio)	-12.5%	Lean	More than 3.4 V
O2S B1S2 (Heated oxygen)	+25%	Rich	More than 0.55 V
O2S B1S2 (Heated oxygen)	-12.5%	Lean	Less than 0.4 V

NOTICE:

The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

Case	Air Fuel Ratio Sensor (Sensor 1) Output Voltage	Heated Oxygen Sensor (Sensor 2) Output Voltage	Main Suspected Trouble Area
1			-
2			• Air fuel ratio sensor

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Case	Air Fuel Ratio Sensor (Sensor 1) Output Voltage	Heated Oxygen Sensor (Sensor 2) Output Voltage	Main Suspected Trouble Area
			• Air fuel ratio sensor heater • Air fuel ratio sensor circuit
3			• Heated oxygen sensor • Heated oxygen sensor heater • Heated oxygen sensor circuit • Exhaust gas leaks
4			• Fuel pressure • Exhaust gas leaks (Air fuel ratio extremely lean or rich)

- Performing Control the Injection Volume for A/F Sensor enables technicians to check and graph the output voltages of both the air fuel ratio and heated oxygen sensors.
- To display the graph, enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor / AFS Voltage B1S1 and O2S B2S1.

HINT:

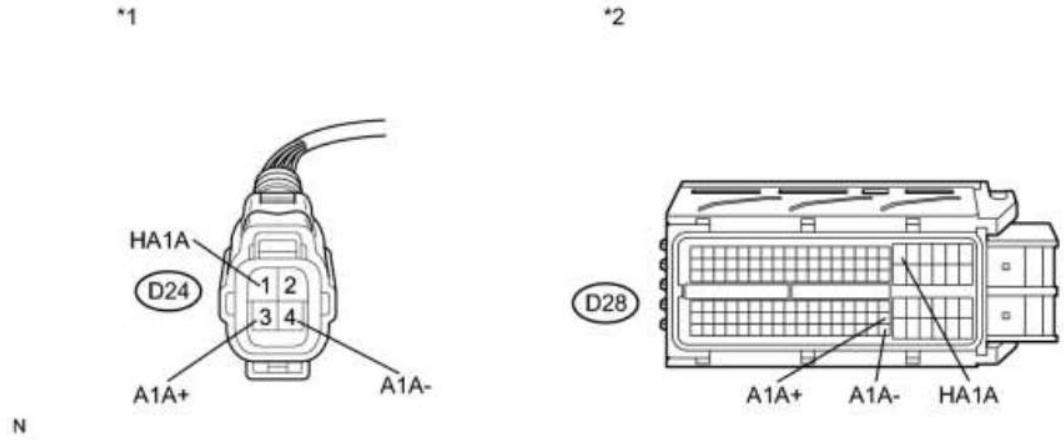
Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - ECM)

(a) Disconnect the air fuel ratio sensor connector.

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(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D24-1 (HA1A) - D28-18 (HA1A)	Always	Below 1 Ω
D24-3 (A1A+) - D28-103 (A1A+)		
D24-4 (A1A-) - D28-126 (A1A-)		

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D24-1 (HA1A) or D28-18 (HA1A) - Body ground	Always	10 kΩ or higher
D24-3 (A1A+) or D28-103 (A1A+) - Body ground		
D24-4 (A1A-) or D28-126 (A1A-) - Body ground		

Text in Illustration

*1	Front view of wire harness connector (to Air Fuel Ratio Sensor)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the air fuel ratio sensor connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (AIR FUEL RATIO SENSOR - ECM)
OK
▼

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2.	REPLACE AIR FUEL RATIO SENSOR

(a) Replace the air fuel ratio sensor INFO.

NEXT

3.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs.

(e) Put the engine in inspection mode INFO.

(f) Drive the vehicle referring to the Confirmation Driving Pattern.

NEXT

4.	CHECK WHETHER DTC OUTPUT RECURS

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(e) Read the Pending DTCs.

Result:

Result	Proceed to
DTC is not output	A
DTC P2237, P2238, P2239, P2252 or P2253 is output	B

B ▶ REPLACE ECM

A ▶ **END**

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DTC	P2420	Evaporative Emission System Switching Valve Control Circuit High

DTC SUMMARY

DTC No.	Monitoring Item	DTC Detection Condition	Trouble Area	Detection Timing	Detection Logic
P2420	Vent valve stuck open (vent)	The following condition is met during key-off EVAP monitor • EVAP pressure change when vent valve is closed (ON) less than 2.3 mmHg	• Canister pump module (0.02 inch orifice, vacuum pump, vent valve) • Connector/wire harness (canister pump module - ECM) • ECM	Power switch off	2 trip

HINT:

The vent valve is built into the canister pump module.

DESCRIPTION

The circuit description can be found in the EVAP (Evaporative Emission) System INFO.

INSPECTION PROCEDURE

Refer to the EVAP System INFO.

MONITOR DESCRIPTION

5 hours*1 after the power switch is turned off, the leak detection pump creates negative pressure (vacuum) in the EVAP (Evaporative Emission) system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.

HINT:

*1: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the power switch is turned off, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the power switch is turned off, the monitor check starts 2.5 hours later.

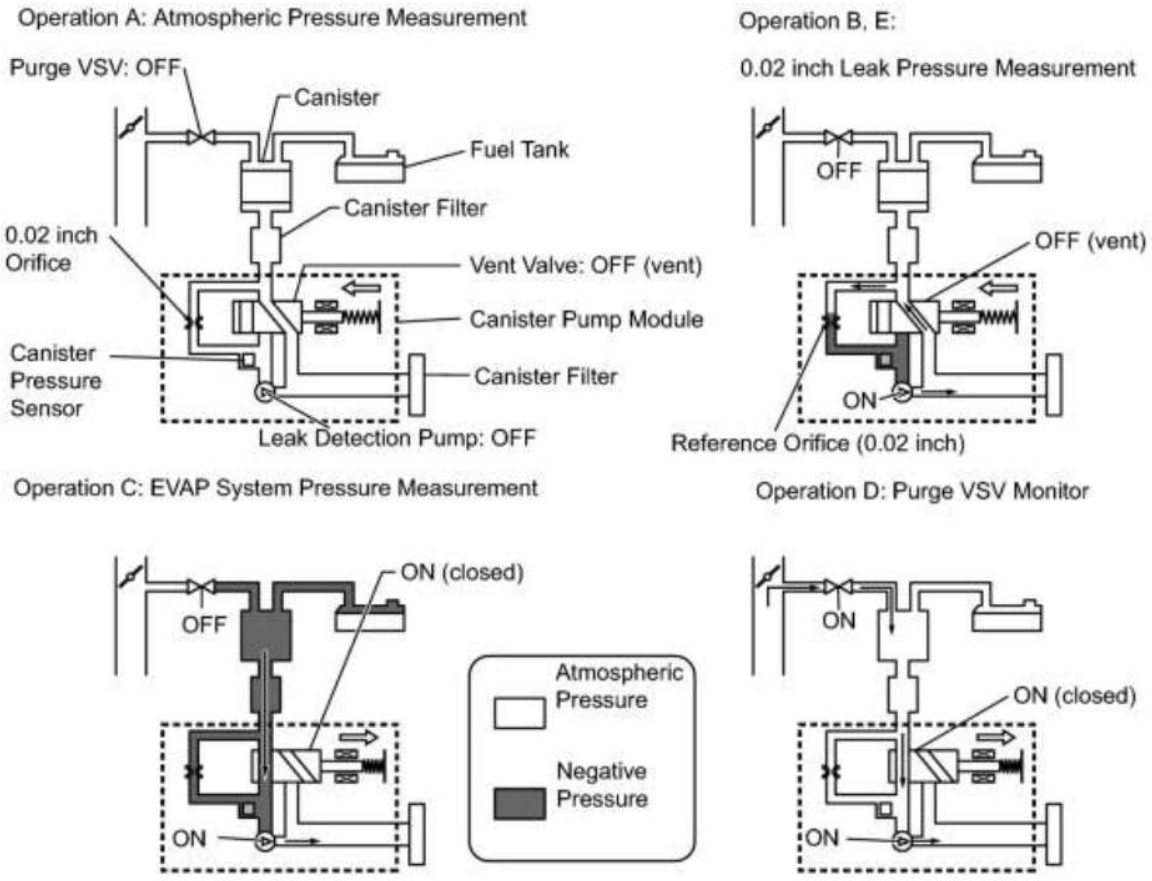
Sequence	Operation	Description	Duration
-	ECM activation	Activated by soak timer, 5 hours (7 or 9.5 hours) after power switch is turned off.	-
A	Atmospheric pressure measurement	Vent valve is turned off (vent) and EVAP system pressure is measured by ECM in order to register atmospheric pressure. If pressure in EVAP system is not between 70 kPa and 112 kPa	60 seconds

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Sequence	Operation	Description	Duration
		(525 mmHg and 840 mmHg), ECM cancels EVAP system monitor.	
B	First 0.02 inch leak pressure measurement	In order to determine 0.02 inch leak pressure standard, vacuum pump creates negative pressure (vacuum) through 0.02 inch orifice and then ECM checks if vacuum pump and vent valve operate normally.	360 seconds
C	EVAP system pressure measurement	Vent valve is turned on (closed) to shut EVAP system. Negative pressure (vacuum) is created in EVAP system, and then EVAP system pressure is measured. Write down measured value as they will be used in leak check. If EVAP pressure does not stabilize within 15 minutes, ECM cancels EVAP system monitor.	15 minutes*2
D	Purge VSV monitor	Purge VSV is opened and then EVAP system pressure is measured by ECM. Large increase indicates normal.	10 seconds
E	Second 0.02 inch leak pressure measurement	After second 0.02 inch leak pressure measurement, leak check is performed by comparing first and second 0.02 inch leak pressure standards. If stabilized system pressure is higher than second 0.02 inch leak pressure standard, ECM determines that there is a leak in EVAP system.	60 seconds
F	Final check	Atmospheric pressure is measured and then monitoring result is recorded by ECM.	-

*2: If only a small amount of fuel is in the fuel tank, it takes longer for the EVAP pressure to stabilize.

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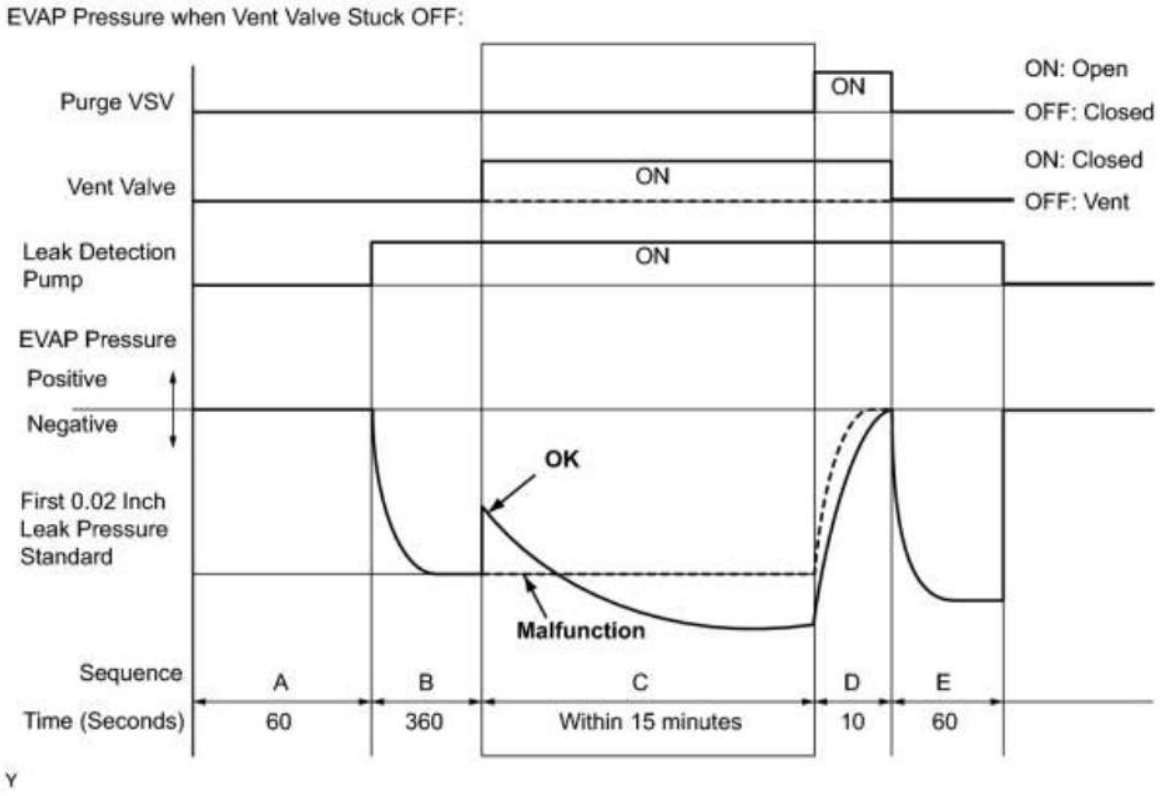


c

P2420: Vent valve stuck open (vent)

In operation C, the vent valve turns on (closed) and the EVAP system pressure is then measured by the ECM, using the canister pressure sensor, to conduct an EVAP leak check. If the pressure does not increase when the vent valve is open, the ECM interprets this as the vent valve being stuck open. The ECM illuminates the MIL and sets the DTC.

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MONITOR STRATEGY

Related DTC	P2420: Vent valve stuck open
Required Sensors/Components	Purge VSV and canister pump module
Frequency of Operation	Once per driving cycle
Duration	Within 2 minutes (varies with amount of fuel in tank)
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
Atmospheric pressure	70 to 112 kPa (525 to 840 mmHg)
Battery voltage	10.5 V or more
Vehicle speed	Below 2.5 mph (4 km/h)
Power switch	OFF
Time after key off	5, 7 or 9.5 hours
Canister pressure sensor malfunction (P0452 and P0453)	Not detected
Purge VSV	Not operated by scan tool
Vent valve	Not operated by scan tool

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Leak detection pump	Not operated by scan tool
Both of the following conditions are met before key off	Conditions 1 and 2
1. Duration that vehicle has been driven	5 minutes or more
2. EVAP purge operation	Performed
Engine coolant temperature	4.4 to 35°C (40 to 95°F)
Intake air temperature	4.4 to 35°C (40 to 95°F)

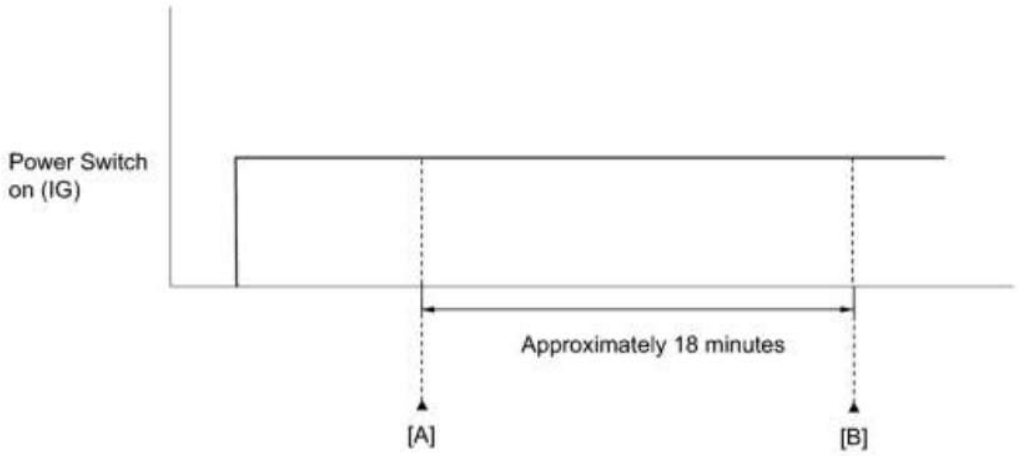
TYPICAL MALFUNCTION THRESHOLDS

EVAP pressure change after vent valve on	Less than 0.3 kPa (2.25 mmHg)

MONITOR RESULT

Refer to Checking Monitor Status INFO.

CONFIRMATION DRIVING PATTERN



NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 18 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or higher, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F).

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1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on.
6. Enter the following menus: Powertrain / Engine and ECT / Utility / Evaporative System Check / Automatic Mode [A].
7. After the "Evaporative System Check" is completed, check for All Readiness by entering the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
8. Read the pending DTC [B].
9. If a pending DTC is output, the system is malfunctioning.

   HINT:

   If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: P2420.
12. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

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HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform step [B].

13. If the test result is UNKNOWN, enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
14. Read Pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

15. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

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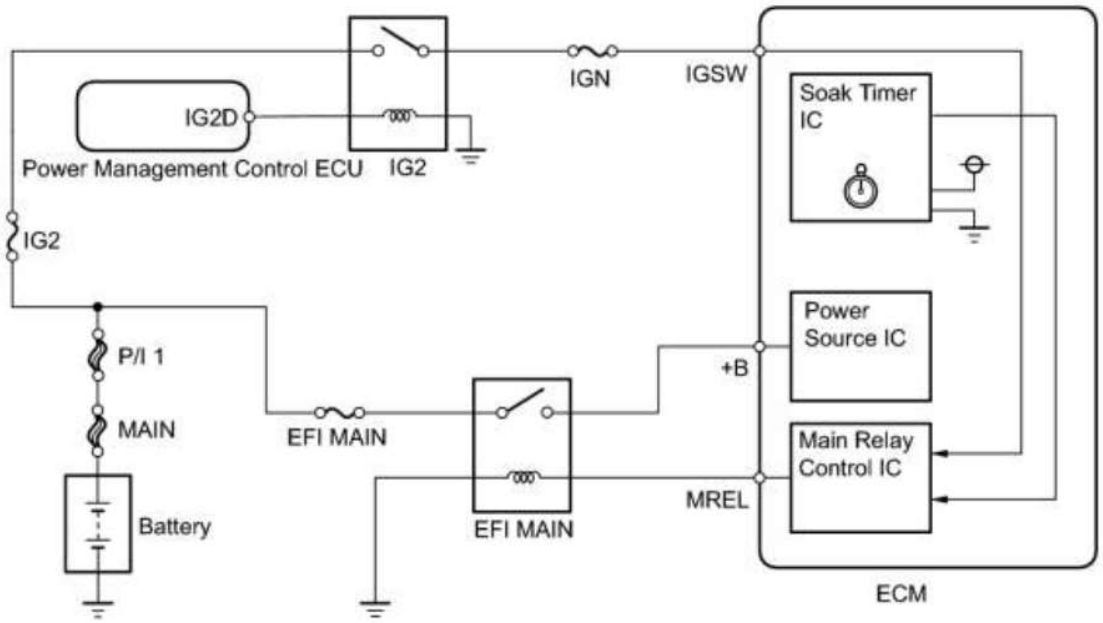
DTC	P2610	ECM / PCM Internal Engine Off Timer Performance

DTC SUMMARY

DTC No.	Monitoring Item	Malfunction Detection Condition	Trouble Area	Detection Timing	Detection Logic
P2610	Soak timer (built into ECM)	ECM internal malfunction	ECM	Engine running	2 trip

DESCRIPTION

The soak timer operates after the power switch is turned off. When a certain amount of time has elapsed after turning the power switch off, the soak timer activates the ECM to perform malfunction checks witch can only be performed after the engine is stopped. The soak timer is built into the ECM.



MONITOR DESCRIPTION

If the soak timer activates the ECM even though only a short amount of time has elapsed since the power switch was turned off, or if the soak timer does not activate the ECM even though a considerable amount of time has elapsed since the power switch was turned off, the ECM determines that the soak timer is malfunctioning, illuminates the MIL and stores a DTC the next time the power switch is turned on (IG).

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While the engine is running, the ECM monitors the synchronization of the soak timer and the CPU clock. If these two are not synchronized, the ECM interprets this as a malfunction, illuminates the MIL and sets the DTC (2 trip detection logic).

MONITOR STRATEGY

Related DTC	P2610: ECM internal engine off timer performance
Required Sensors / Components	ECM
Frequency of Operation	Once per driving cycle
Duration	10 minutes
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All:

Monitor runs whenever following DTCs are not present	None

Case 1:

Power switch	On (IG)
Engine	Running
Battery voltage	8 V or more
CPU clock elapsed time	10 minutes or more

Case 2:

Internal engine OFF timer (elapsed time from engine stop)	10 minutes or more
Battery voltage	8 V or more
Power switch	On (IG)

Case 3:

Internal engine OFF timer (elapsed time from engine stop)	10 minutes or more
Battery voltage	8 V or more
Power switch	On (IG)

TYPICAL MALFUNCTION THRESHOLDS

Case 1:

Internal engine OFF timer (elapsed time from engine start)	Less than 7 minutes, or more than 13 minutes

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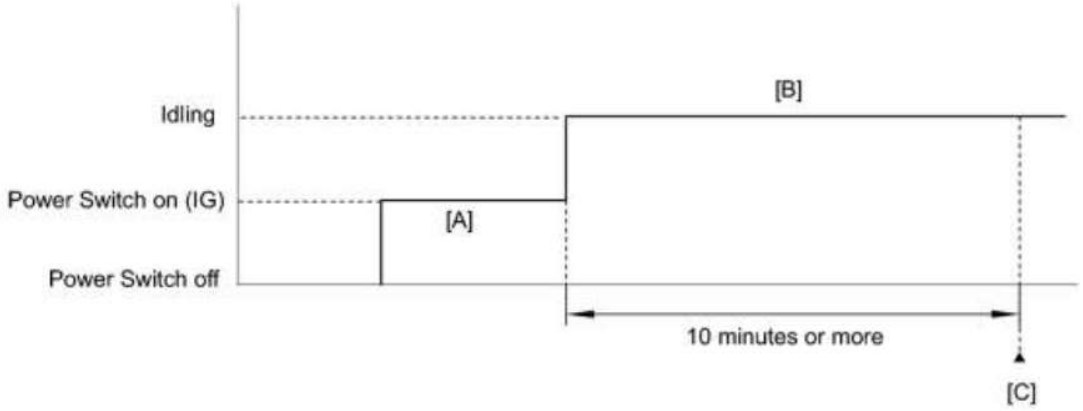
Case 2:

ECM had the started record by internal engine OFF timer	Yes

Case 3:

ECM had the started record by internal engine OFF timer	No

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine.
8. Idle the engine for 10 minutes or more [B].
9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
10. Read the pending DTC [C].
11. If a pending DTC is output, the system is malfunctioning.

    HINT:

    If a pending DTC is not output, perform the following procedure.

12. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
13. Input the DTC: P2610.
14. Check the DTC judgment result.

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Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform step [B] again.

15. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
16. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

17. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

- DTC P2610 is set if an internal ECM problem is detected. Diagnostic procedures are not required. ECM replacement is required.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

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1.	REPLACE ECM

(a) Replace the ECM INFO.

NEXT

2.	CHECK WHETHER DTC OUTPUT RECURS

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Put the engine in inspection mode INFO.

(f) Start the engine and wait for 10 minutes or more.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(h) If no pending DTC is displayed, the repair has been successfully completed.

NEXT **END**

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DTC	P261B	Coolant Pump "B" Control Malfunction
DTC	P261C	Short in Coolant Pump "B" Control Circuit
DTC	P261D	Open in Coolant Pump "B" Control Circuit

DESCRIPTION

The ECM controls the water pump assembly by calculating the necessary amount of coolant flow based on engine coolant temperature, engine speed and vehicle speed information. The speed of the water pump assembly is controlled steplessly using duty cycle signal sent from the ECM. This optimal control enhances warm-up performance and reduces cooling losses, thus reducing the specific fuel consumption of the engine.

DTC No.	DTC Detection Condition	Trouble Area
P261B	Water pump speed is less than 900 rpm while the water pump assembly is operating (1 trip detection logic)	• Open or short in water pump assembly circuit • Water pump assembly • ECM
P261C	Water pump output voltage is less than specified value while the water pump assembly is operating (1 trip detection logic)	• Short in water pump assembly circuit • Water pump assembly • ECM
P261D	Water pump output voltage is higher than specified value while the water pump assembly is operating (1 trip detection logic)	• Open in water pump assembly circuit • Water pump assembly • ECM

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MONITOR DESCRIPTION

The ECM calculates the speed of the water pump assembly using a duty cycle signal sent from the water pump assembly. When the speed of the water pump assembly becomes less than 900 rpm while it is operating, the ECM detects the malfunction and stores DTC P261B.

The water pump assembly operates steplessly based on a duty cycle signal sent from the ECM. The ECM monitors the current of the water pump assembly. If actual drive duty cycle ratio does not correspond to the target drive duty cycle , the ECM detects the malfunction and stores DTC P261C and P261D.

MONITOR STRATEGY

Related DTCs	P261B: Engine coolant pump circuit performance P261C: Engine coolant pump circuit range check (low voltage) P261D: Engine coolant pump circuit range check (high voltage)

Required Sensors/Components (Main)	Water pump assembly
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	15 seconds: Engine coolant pump circuit performance 3 seconds: Engine coolant pump circuit range check (low voltage, high voltage)
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not present	None
Battery voltage	8 V or more
Power switch	On (IG)
Time after power switch off to on (IG)	0.5 seconds or more

P261B: Engine Coolant Pump Circuit Performance

Output signal duty ratio	40% or more
Monitor synchronism monitor status	Enable
Engine coolant temperature	-10°C (14 °F) or more
Engine coolant temperature circuit circuit fail (P0115, P0117, P0118)	Not detected
Engine coolant pump circuit range check low voltage fail (P261C)	Not detected
Engine coolant pump circuit range check high voltage fail (P261D)	Not detected

P261C, P261D: Engine Coolant Pump Circuit Range Check (Low Voltage, High Voltage)

Output signal duty ratio	40 to 60%
Engine coolant pump circuit performance fail (P261B)	Not detected
Engine coolant pump output terminal voltage monitor counter	0.08 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

P261B: Engine Coolant Pump Circuit Performance

Motor speed	Less than 900 rpm

P261C: Engine Coolant Pump Circuit Range Check (Low Voltage)

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Current engine coolant pump output terminal voltage	Low
Engine coolant pump output monitor	Fail

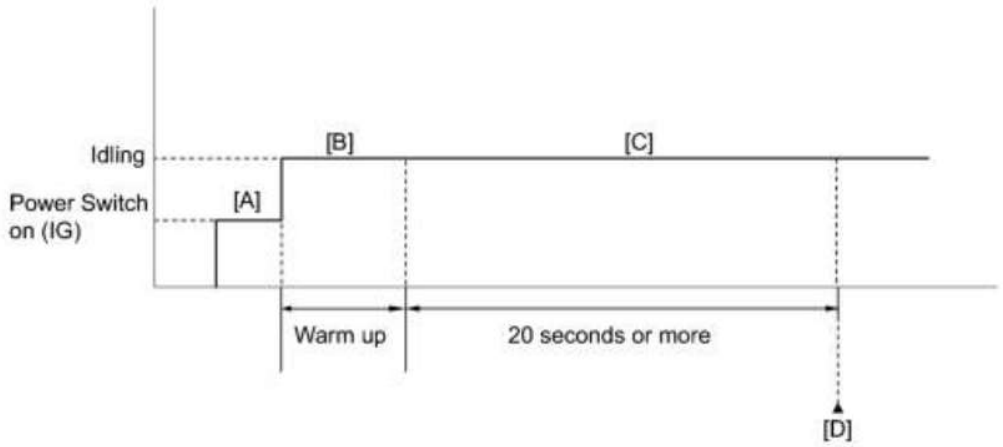
P261D: Engine Coolant Pump Circuit Range Check (High Voltage)

Current engine coolant pump output terminal voltage	High
Engine coolant pump output monitor	Fail

COMPONENT OPERATING RANGE

Motor speed	900 rpm or more

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine and warm it up (until the engine coolant temperature is 75°C (167°F) or higher) [B].
8. Idle the engine for 20 seconds or more [C].
9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
10. Read the DTC [D].
11. If the DTC is output, the system is malfunctioning.

HINT:

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If a DTC is not output, perform the following procedure.

12. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
13. Input the DTC: P261B, P261C or P261D.
14. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [C] again.

15. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
16. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

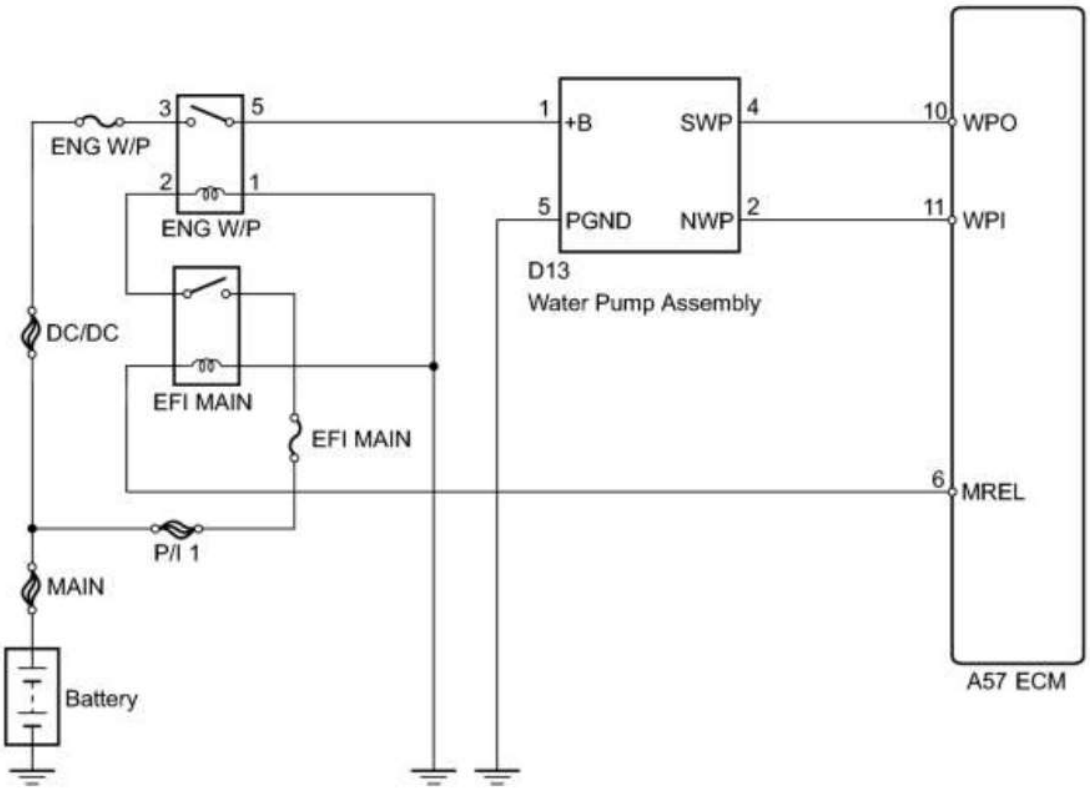
17. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	PERFORM ACTIVE TEST USING TECHSTREAM (ACTIVATE THE ELECTRIC WATER PUMP)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

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(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Activate the Electric Water Pump.

(g) Touch the water pump and check that the pump is operating (vibrating).

OK:

The water pump is operating (vibrating).

NG ▶ CHECK WATER PUMP ASSEMBLY (POWER SOURCE)

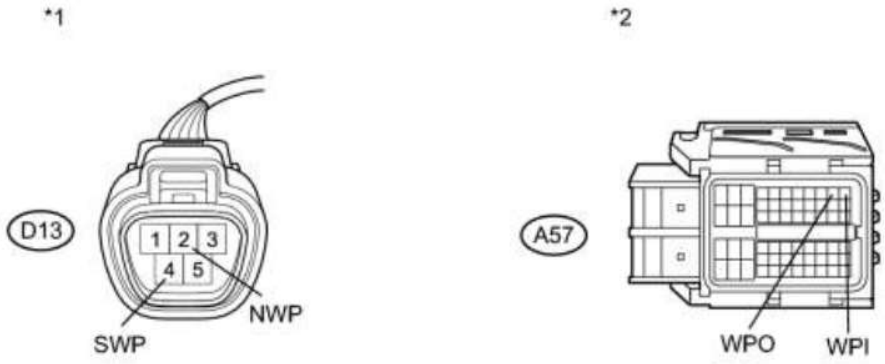
OK ▼

2.	CHECK HARNESS AND CONNECTOR (WATER PUMP ASSEMBLY - ECM)

HINT:

Confirm a good connection at the water pump assembly and ECM connectors.

(a) Disconnect the water pump assembly connector.



(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D13-2 (NWP) - A57-11 (WPI)	Always	Below 1 Ω

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Tester Connection	Condition	Specified Condition
D13-4 (SWP) - A57-10 (WPO)	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D13-2 (NWP) or A57-11 (WPI) - Body ground	Always	10 kΩ or higher
D13-4 (SWP) or A57-10 (WPO) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Water Pump Assembly)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the water pump assembly connector.

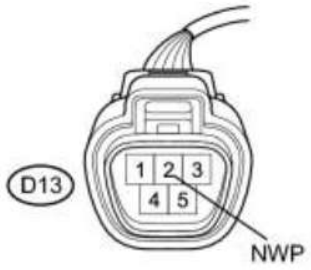
(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (WATER PUMP ASSEMBLY - ECM)

OK ▼

3.	CHECK ECM (WPI VOLTAGE)

*1



(a) Disconnect the water pump assembly connector.

c

(b) Turn the power switch on (IG).

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
D13-2 (NWP) - Body ground	Power switch on (IG)	11 to 14 V

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Text in Illustration

*1	Front view of wire harness connector (to Water Pump Assembly)

(d) Reconnect the water pump assembly connector.

NG ▶ REPLACE ECM
OK ▶ **REPLACE WATER PUMP ASSEMBLY**

4.	CHECK WATER PUMP ASSEMBLY (POWER SOURCE)

HINT:

Confirm a good connection at the water pump assembly and ECM connectors.

*1



(a) Disconnect the water pump assembly connector.

c

(b) Turn the power switch on (IG).

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
D13-1 (+B) - Body ground	Power switch on (IG)	11 to 14 V

Text in Illustration

*1	Front view of wire harness connector (to Water Pump Assembly)

(d) Reconnect the water pump assembly connector.

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NG ▶ INSPECT ENG W/P RELAY

OK ▼

5.	CHECK HARNESS AND CONNECTOR (WATER PUMP ASSEMBLY - BODY GROUND)

*1



(a) Disconnect the water pump assembly connector.

c

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Switch Condition	Specified Condition
D13-5 (PGND) - Body ground	Always	Below 1 Ω

Text in Illustration

*1	Front view of wire harness connector (to Water Pump Assembly)

(c) Reconnect the water pump assembly connector.

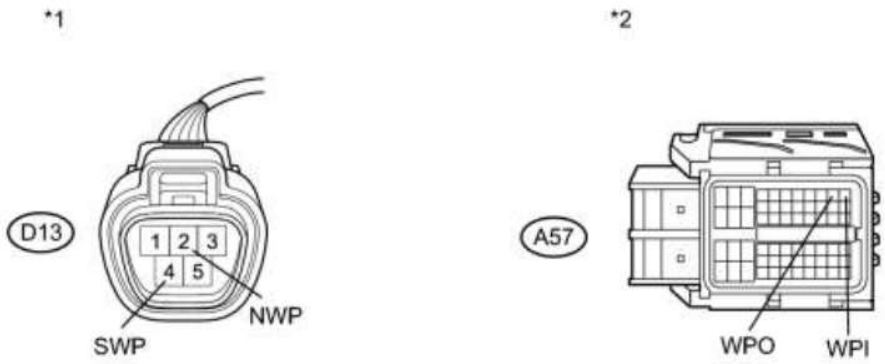
NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (WATER PUMP ASSEMBLY - BODY GROUND)

OK ▼

6.	CHECK HARNESS AND CONNECTOR (WATER PUMP ASSEMBLY - ECM)

(a) Disconnect the water pump assembly connector.

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(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D13-2 (NWP) - A57-11 (WPI)	Always	Below 1 Ω
D13-4 (SWP) - A57-10 (WPO)	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D13-2 (NWP) or A57-11 (WPI) - Body ground	Always	10 kΩ or higher
D13-4 (SWP) or A57-10 (WPO) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Water Pump Assembly)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the water pump assembly connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (WATER PUMP ASSEMBLY - ECM)

OK

▼

7.	REPLACE WATER PUMP ASSEMBLY

(a) Replace the water pump assembly INFO.

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NEXT

8.	CHECK WHETHER DTC OUTPUT RECURS (DTC P261B, P261C OR P261D)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on.

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(f) Enter the following menus: Powertrain / Engine and ECT / Trouble codes.

(g) Read the DTCs.

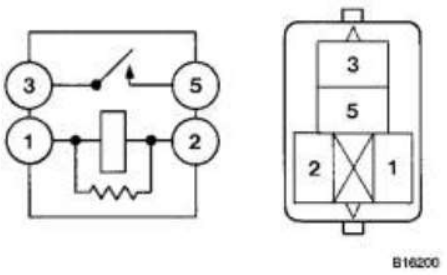
Result:

Result	Proceed to
DTC P261B, P261C or P261D is output	A
DTC is not output	B

B ▶ END

A ▶ **REPLACE ECM**

9.	INSPECT ENG W/P RELAY



(a) Remove the ENG W/P relay from the engine room relay block.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
3 - 5	No battery voltage applied between terminals 1 and 2	10 kΩ or higher
3 - 5	Battery voltage applied between terminals 1 and 2	Below 1 Ω

(c) Reinstall the ENG W/P relay to the engine room relay block.

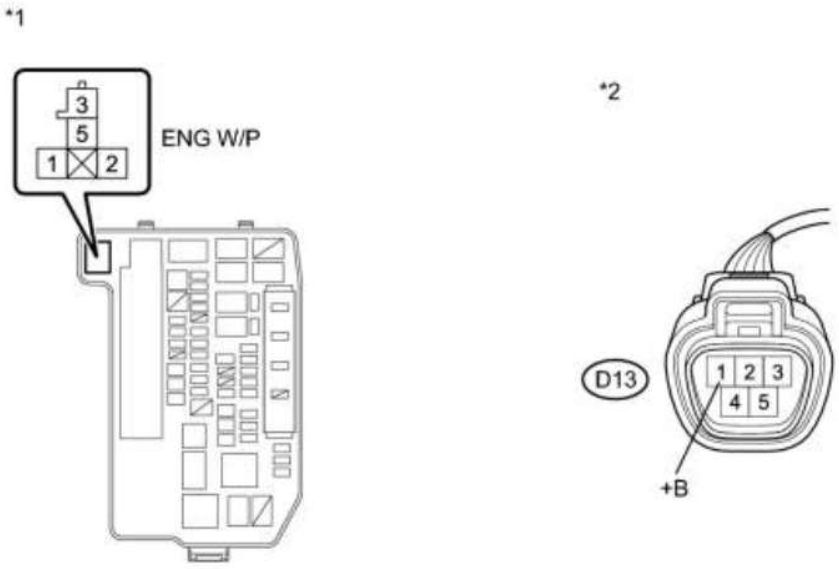
NG ▶ REPLACE ENG W/P RELAY

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OK

10.	CHECK HARNESS AND CONNECTOR (ENG W/P RELAY - WATER PUMP ASSEMBLY)

(a) Remove the ENG W/P relay from the engine room relay block.



(b) Disconnect the water pump assembly connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
ENG W/P relay terminal 5 - D13-1 (+B)	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
ENG W/P relay terminal 5 or D13-1 (+B) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Engine Room Relay Block	*2	Front view of wire harness connector (to Water Pump Assembly)

(d) Reinstall the ENG W/P relay to the engine room relay block.

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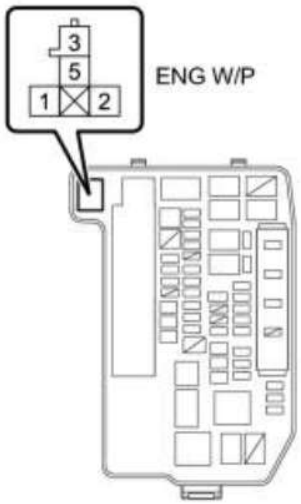
(e) Reconnect the water pump assembly connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (ENG W/P RELAY - WATER PUMP ASSEMBLY)

OK ▼

11.	CHECK ENG W/P RELAY (POWER SOURCE)

*1



(a) Remove the ENG W/P relay from the engine room relay block.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
ENG W/P relay terminal 3 - Body ground	Always	11 to 14 V

Text in Illustration

*1	Engine Room Relay Block

(c) Reinstall the ENG W/P relay to the engine room relay block.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (ENG W/P RELAY - BATTERY)

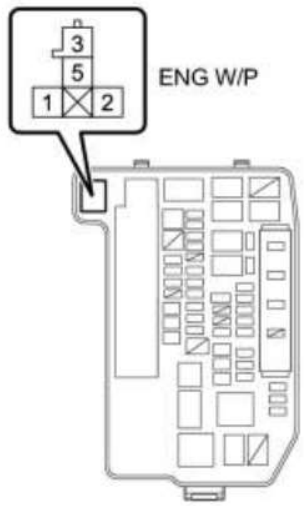
OK ▼

12.	CHECK HARNESS AND CONNECTOR (ENG W/P RELAY - BODY GROUND)

(a) Remove the ENG W/P relay from the engine room relay block.

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*1



(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Switch Condition	Specified Condition
ENG W/P relay terminal 1 - Body ground	Always	Below 1 Ω

Text in Illustration

*1	Engine Room Relay Block

(c) Reinstall the ENG W/P relay to the engine room relay block.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (ENG W/P RELAY - BODY GROUND)
OK ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (ENG W/P RELAY - EFI MAIN RELAY)**

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DTC	P2A00	A/F Sensor Circuit Slow Response (Bank 1 Sensor 1)

DESCRIPTION

HINT:

- Refer to DTC P2195 INFO.
- Sensor 1 refers to the sensor mounted in front of the three-way catalytic converter and located near the engine assembly.

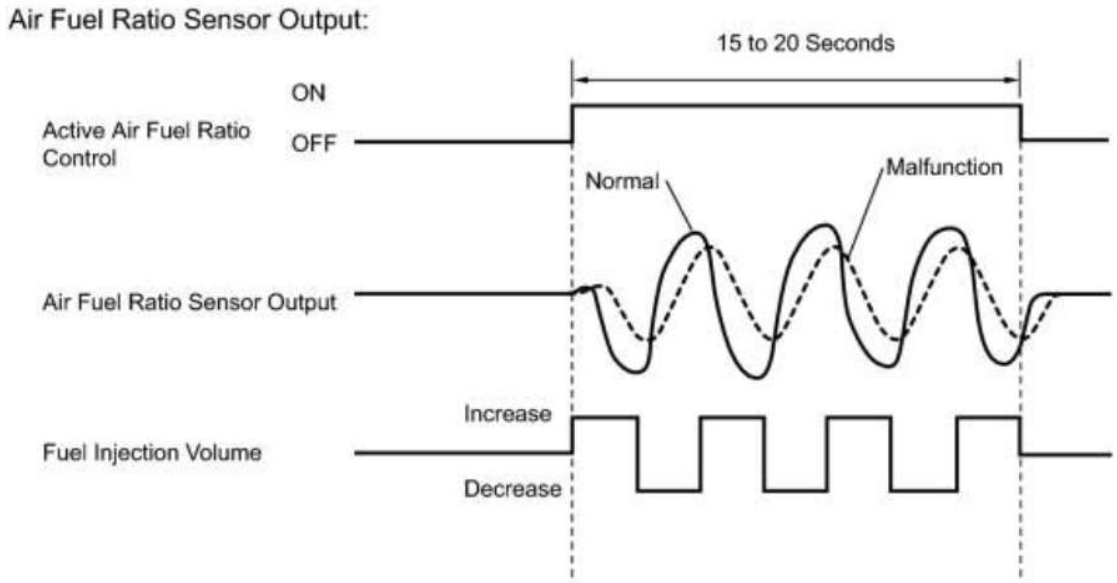
DTC No.	DTC Detection Condition	Trouble Area
P2A00	Calculated value for air fuel ratio sensor response rate deterioration level is less than threshold (2 trip detection logic)	• Air fuel ratio sensor • Air fuel ratio sensor heater • EGR valve assembly • ECM

MONITOR DESCRIPTION

After the engine is warmed up, the ECM performs air fuel ratio feedback control to maintain the air fuel ratio at the stoichiometric level. In addition, active A/F control is performed for approximately 15 to 20 seconds after preconditions are met in order to measure the air fuel ratio sensor response rate. During active A/F control, the ECM forcibly increases and decreases the injection volume a certain amount, based on the stoichiometric air fuel ratio learned during normal air fuel ratio control, and measures the air fuel ratio sensor response rate. The ECM receives a signal from the air fuel ratio sensor while performing active A/F control and uses it to calculate the air fuel ratio sensor response rate deterioration level.

If the value for air fuel ratio sensor response rate deterioration level is beyond the threshold, the ECM interprets this as a malfunction and sets the DTC.

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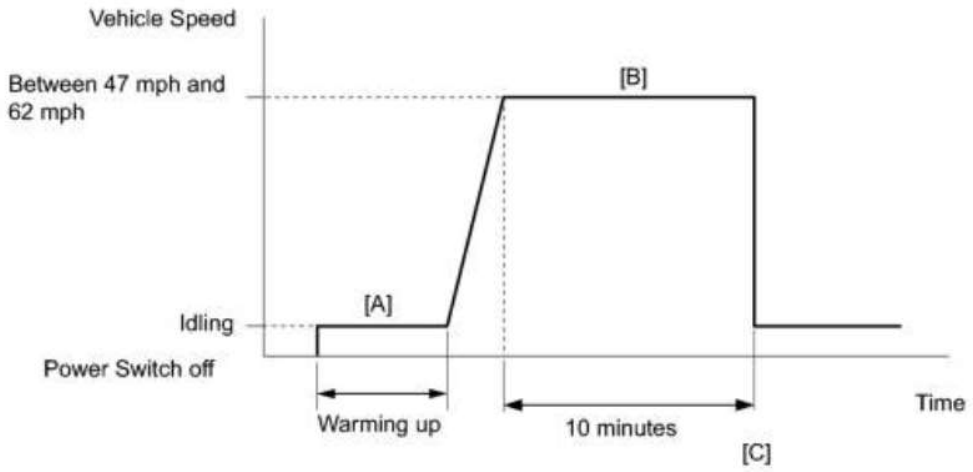
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CONFIRMATION DRIVING PATTERN

HINT:

This confirmation driving pattern is used in the "Perform Confirmation Driving Pattern" procedure of the following diagnostic troubleshooting procedure.

Performing this confirmation pattern will activate the air fuel ratio sensor response monitor.



P

1. Connect the Techstream to the DLC3.
2. Turn the power switch on ((IG).

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3. Turn the Techstream on.
4. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
5. Turn the power switch off and wait for 30 seconds.
6. Turn the power switch on (IG) and turn the Techstream on.
7. Enter the following menus: Powertrain / Engine and ECT / Monitor / O2 Sensor.
8. Check that the Status2 of O2 Sensor is Incomplete.
9. Put the engine in inspection mode INFO.
10. Start the engine and warm it up (until the engine coolant temperature is 75°C (167°F) or higher) [A].
11. Drive the vehicle at a constant speed of between 47 and 62 mph (75 and 100 km/h) for 10 minutes [B].
12. Those items will change to Complete after completing the drive pattern.
13. If the values indicated on the Techstream do not change, perform Readiness Monitor Drive Pattern for the air fuel ratio sensor and heated oxygen sensor INFO.
14. Check the monitor result values on the Techstream by entering the following menus: Powertrain / Engine and ECT / Monitor / O2 Sensor / Details / RANGE B1S1.
15. Note the value of the Monitor Result.
16. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
17. Read the pending DTC [C].
18. If a pending DTC is output, the system is malfunctioning.

HINT:

If a pending DTC is not output, perform the following procedure.

19. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
20. Input the DTC: P2A00.
21. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [B] again.

22. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

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23. Check the judgment result.

    HINT:

    - If the judgment result shows ABNORMAL, the system has a malfunction.
    - If the judgment result shows NORMAL, the system is normal.

24. If the test result is INCOMPLETE or UNKNOWN and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO.

    HINT:

    - If a permanent DTC is output, the system is malfunctioning.
    - If no permanent DTC is output, the system is normal.

MONITOR STRATEGY

Related DTCs	P2A00: Air fuel ratio sensor (bank 1) slow response
Required Sensors/Components (Main)	Air fuel ratio sensor
Required Sensors/Components (Related)	Vehicle speed sensor, Crankshaft position sensor
Frequency of Operation	Once per driving cycle
Duration	15 to 20 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	P0016 (VVT System Bank 1 - Misalignment) P0031, P0032, P101D (Air Fuel Ratio Sensor Heater - Sensor 1) P0102, P0103 (Mass Air Flow Meter) P0107, P0108 (Manifold Absolute Pressure) P0112, P0113 (Intake Air Temperature Sensor) P0115, P0117, P0118 (Engine Coolant Temperature Sensor) P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (Throttle Position Sensor) P0125 (Insufficient Engine Coolant Temperature for Closed Loop Fuel Control) P0128 (Thermostat)

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	P0171, P0172 (Fuel System) P0301, P0302, P0303, P0304 (Misfire) P0335 (Crankshaft Position Sensor) P0401 (EGR System (Closed)) P0451, P0452, P0453 (EVAP System) P0505 (Idle speed control)
Active air fuel ratio control	Performing
Active air fuel ratio control performed when following conditions met	-
Battery voltage	11 V or more
Engine coolant temperature	75°C (167°F) or more
Idling	OFF
Engine speed	Less than 4000 rpm
Air fuel ratio sensor status	Activated
Fuel-cut	OFF
Engine load	10 to 70%
Catalyst monitor	Not yet
Mass air flow	4.5 to 12 gm/sec

TYPICAL MALFUNCTION THRESHOLDS

Response rate deterioration level	Less than 0.17 V

MONITOR RESULT

Refer to Checking Monitor Status INFO.

WIRING DIAGRAM

Refer to DTC P2195 INFO.

INSPECTION PROCEDURE

HINT:

Malfunctioning areas can be identified by performing the Control the Injection Volume for A/F Sensor in the Active Test. The Control the Injection Volume for A/F Sensor function can help to determine whether the air fuel ratio sensor, heated oxygen sensor and other potential trouble areas are malfunctioning.

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The following instructions describe how to conduct the Control the Injection Volume for A/F Sensor operation using the Techstream.

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Put the engine in inspection mode INFO.
4. Start the engine.
5. Warm up the engine at an engine speed of 2500 rpm for approximately 90 seconds.
6. Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor.
7. Perform the Active Test operation with the engine idling (press the RIGHT or LEFT button to change the fuel injection volume).
8. Monitor the output voltages of the air fuel ratio and heated oxygen sensors (AFS Voltage B1S1 and O2S B1S2) displayed on the Techstream.

HINT:

- The Control the Injection Volume for A/F Sensor operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
- Each sensor reacts in accordance with increases in the fuel injection volume.

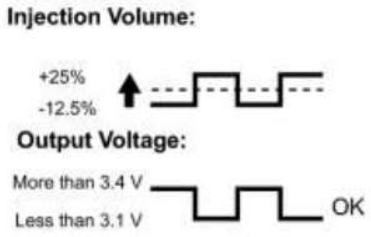
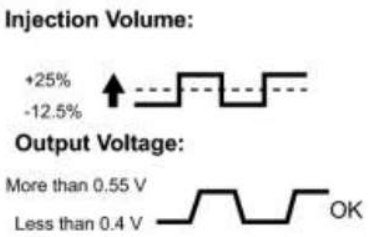
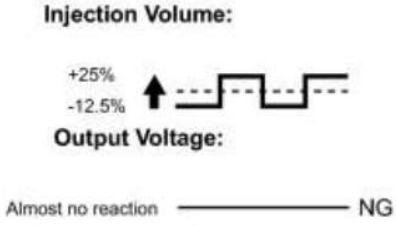
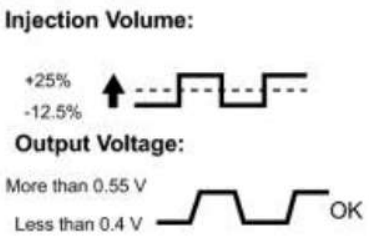
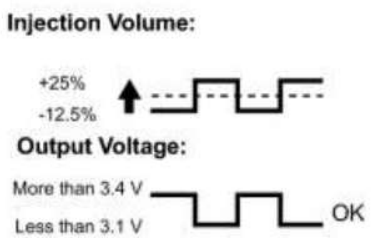
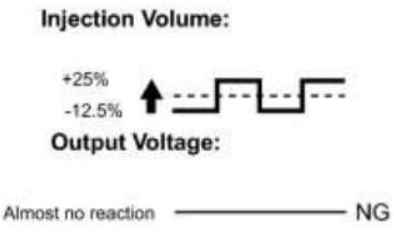
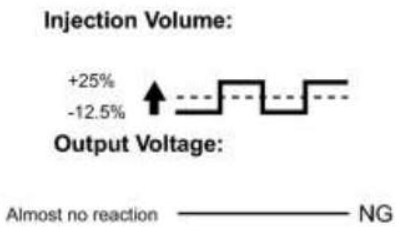
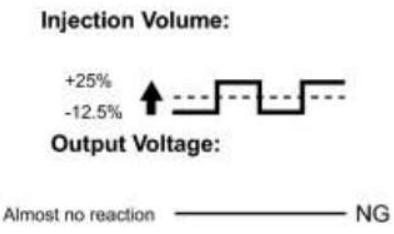
Techstream Display (Sensor)	Injection Volume	Status	Voltage
AFS Voltage B1S1 (Air fuel ratio)	+25%	Rich	Less than 3.1 V
AFS Voltage B1S1 (Air fuel ratio)	-12.5%	Lean	More than 3.4 V
O2S B1S2 (Heated oxygen)	+25%	Rich	More than 0.55 V
O2S B1S2 (Heated oxygen)	-12.5%	Lean	Less than 0.4 V

NOTICE:

The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

Case	Air Fuel Ratio Sensor (Sensor 1) Output Voltage	Heated Oxygen Sensor (Sensor 2) Output Voltage	Main Suspected Trouble Area
1			-

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Case	Air Fuel Ratio Sensor (Sensor 1) Output Voltage	Heated Oxygen Sensor (Sensor 2) Output Voltage	Main Suspected Trouble Area
			
2			• Air fuel ratio sensor • Air fuel ratio sensor heater • Air fuel ratio sensor circuit
3			• Heated oxygen sensor • Heated oxygen sensor heater • Heated oxygen sensor circuit • Exhaust gas leaks
4			• Fuel pressure • Exhaust gas leaks (Air fuel ratio extremely lean or rich)

- Performing Control the Injection Volume for A/F Sensor enables technicians to check and graph the voltage outputs of both the air fuel ratio and heated oxygen sensors.
- To display the graph, enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Injection Volume for A/F Sensor / A/F Control System / AFS Voltage B1S1 and O2S B1S2.

HINT:

- DTC P2A00 may also be set when the air fuel ratio remains rich or lean.
- A low air fuel ratio sensor voltage could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.

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- A high air fuel ratio sensor voltage could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P2A00)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result:

Result	Proceed to
DTC P2A00 is output	A
DTC P2A00 and other DTCs are output	B

HINT:

If any DTCs other than P2A00 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE) INFO

NG ▶ REPLACE AIR FUEL RATIO SENSOR

OK ▼

3.	CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - ECM) INFO

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (AIR FUEL RATIO SENSOR - ECM)

OK ▼

4.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

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(c) Turn the Techstream on.

(d) Clear the DTCs.

(e) Put the engine in inspection mode INFO.

(f) Drive the vehicle referring to the Confirmation Driving Pattern.

NEXT

5.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2A00)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(e) Read the Pending DTCs.

Result:

Result	Proceed to
DTC P2A00 is output	A
DTC is not output	B

B CHECK FOR INTERMITTENT PROBLEMS

A

6.	REPLACE AIR FUEL RATIO SENSOR

(a) Replace the air fuel ratio sensor INFO.

NEXT

7.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs.

(e) Put the engine in inspection mode INFO.

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(f) Drive the vehicle referring to the Confirmation Driving Pattern.

NEXT

8.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2A00)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(e) Read the Pending DTCs.

Result:

Result	Proceed to
DTC P2A00 is output	A
DTC is not output	B

B END

A

9.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.

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- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

Result:

Result	Proceed to
Outside of standard range	A
Within standard range	B

B ▶ REPLACE ECM

A ▼

10.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

NG ▶ REPLACE EGR VALVE ASSEMBLY

OK ▼

11.	REPLACE ECM

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(a) Replace the ECM INFO.

NEXT

12.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTC INFO.

(e) Turn the power switch off and wait for 30 seconds.

(f) Turn the power switch on (IG) and turn the Techstream on.

(g) Put the engine in inspection mode INFO.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(k) Input the DTC: P2A00.

(l) Check the DTC judgment result.

NEXT **END**

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DTC	P3190	Poor Engine Power
DTC	P3191	Engine does not Start
DTC	P3193	Fuel Run Out

DESCRIPTION

From the power management control ECU, the ECM receives data such as power output required for the engine (required output), estimated torque produced by the engine (estimated torque), engine speed of control target (target speed), and whether the engine is in start mode or not. Then, based on the required output and target speed, the ECM calculates a target torque that is to be produced by the engine and compares it with the estimated torque. If the estimated torque is very low compared with the target torque, or the engine start mode continues for the specific duration calculated by the coolant temperature, an abnormal condition is detected.

DTC No.	DTC Detection Condition	Trouble Area
P3190	Following conditions continue at a fixed engine speed or a fixed length of time (1 trip detection logic): • Communication with power management control ECU is normal • Engine speed is a fixed value or more • Engine start mode is not active • Target torque is a fixed value • Ratio of estimated torque against target torque is less than 20%	• Intake system • Throttle body assembly • Fuel pressure • Engine • Mass air flow meter sub-assembly • Out of fuel • Engine coolant temperature sensor • Crankshaft position sensor • Camshaft position sensor • EGR valve assembly • ECM
P3191	Following conditions continue at a fixed engine speed or a fixed length of time (1 trip detection logic): • Communication with power management control ECU is normal • Engine speed is a fixed value or more • Engine start mode is active • Engine start no-determination for 100 engine revolutions or more, and 6 seconds or more	• Intake system • Throttle body assembly • Fuel pressure • Engine • Mass air flow meter sub-assembly • Out of fuel • Engine coolant temperature sensor • Crankshaft position sensor • Camshaft position sensor • EGR valve assembly • ECM
P3193	Following conditions are met (1 trip detection logic): • Fuel low level signal input into ECM • Detection condition for P3190 or P3191 is satisfied	• Out of fuel • ECM

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MONITOR DESCRIPTION

The ECM and power management control ECU are connected by a communication line called CAN. The ECM sends engine speed data and other data to the power management control ECU while the power management control ECU sends the information such as a requirement for the engine power to the ECM using the CAN communication line. When the communication between the ECM and power management control ECU is normal and the following items become a specified condition, the ECM illuminates the MIL and sets a DTC.

1. Engine speed
2. Target torque
3. Ratio of target torque against estimated torque
4. Fuel level

MONITOR STRATEGY

Related DTCs	P3190: Poor engine power P3191: Engine does not start
Required sensors/components	Main sensors: Crankshaft position sensor Related sensors: Power management control ECU
Frequency of operation	Continuous
Duration	100 engine revolutions or 6 seconds
MIL operation	Immediately (MIL illumination)
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
Fuel cut operation	Not operated
Engine speed	650 rpm or more (varies with engine coolant temperature)
Communication with power management control ECU	No malfunction

TYPICAL MALFUNCTION THRESHOLDS

P3190

Time for low engine torque	100 engine revolutions or more, and 6 seconds or more (varies with engine coolant temperature)
Fuel level	Not empty

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P3191

Engine start no-determination time (receive from power management control ECU)	100 engine revolutions or more, and 6 seconds or more (varies with engine coolant temperature)
Fuel level	Not empty

INSPECTION PROCEDURE

HINT:

- Repeating this inspection for symptom confirmation may cause the SOC to drop, preventing the system from entering the READY-on state. In this case, use the THS charger to charge the HV battery.
- Cranking the engine once causes the SOC to drop approximately 1%.
- Charging the HV battery once (10 minutes) using the THS charger restores the SOC approximately 2%.
- Charging the HV battery using the THS charger takes approximately 10 minutes when the battery temperature is 25°C (77°F) or approximately 30 minutes when the battery temperature is 0°C (32°F).
- The THS charger is a supplemental charging device that charges the HV battery enough to enable the engine to start (the vehicle can enter the READY-on state).
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was running or stopped, whether the engine was warmed up or not, whether the air-fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P3190, P3191 AND/OR P3193)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch ON (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Read the DTCs.

Result

Result	Proceed to
DTC P3190, P3191 and/or P3193 are output	A
DTC P3190, P3191 and/or P3193, and other DTCs are output	B

HINT:

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If any other codes besides P3190, P3191 and/or P3193 are output, perform troubleshooting for those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK ANY OTHER DTC OUTPUT BY HYBRID CONTROL SYSTEM

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch ON (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Hybrid Control / Trouble Codes.

(e) Read the DTCs.

Result

Result	Proceed to
DTC is not output	A
Hybrid control system DTC is output	B

B ▶ GO TO HYBRID CONTROL SYSTEM (DTC CHART)

A ▼

3.	CHECK SHORTAGE OF FUEL

NG ▶ REFILL FUEL

OK ▼

4.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO.

OK:

No leaks in intake system.

NG ▶ REPAIR OR REPLACE INTAKE SYSTEM

OK ▼

5.	CHECK FOR UNUSUAL NOISE OR VIBRATION WHEN STARTING ENGINE OR REVVING UP

OK:

Unusual noise and vibration do not occur.

NG ▶ REPAIR OR REPLACE MALFUNCTIONING PART

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OK

6.	CHECK FUEL PRESSURE

(a) Check the fuel pressure INFO.

NG ▶ CHECK FUEL LINE

OK

7.	INSPECT FREEZE FRAME DATA

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT Trouble Codes / Freeze Frame Data.

(e) Calculate the requested torque* and compare it with Actual Engine Torque.

HINT:

*: The requested torque is calculated by putting "Requested Engine Torque" and "HV Target Engine Speed" from the freeze frame data into the following formula:

Requested torque = Requested Engine Torque (kW) / HV Target Engine Speed (rpm) x 6112

Standard:

Actual Engine Torque is 60% or more of the request torque.

Result:

Result	Proceed to
NG	A
OK	B

B ▶ INSPECT MASS AIR FLOW METER SUB-ASSEMBLY

A

8.	INSPECT THROTTLE BODY ASSEMBLY

(a) Inspect the throttle body assembly INFO.

NG ▶ REPLACE THROTTLE BODY ASSEMBLY

OK

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9.	INSPECT MASS AIR FLOW METER SUB-ASSEMBLY

(a) Inspect the mass air flow meter sub-assembly INFO.

NG ▶ REPLACE MASS AIR FLOW METER SUB-ASSEMBLY

OK ▼

10.	INSPECT ENGINE COOLANT TEMPERATURE SENSOR

(a) Inspect the engine coolant temperature sensor INFO.

NG ▶ REPLACE ENGINE COOLANT TEMPERATURE SENSOR

OK ▼

11.	INSPECT CRANKSHAFT POSITION SENSOR

(a) Inspect the crankshaft position sensor INFO.

NG ▶ REPLACE CRANKSHAFT POSITION SENSOR

OK ▼

12.	REPLACE CAMSHAFT POSITION SENSOR

(a) Replace the camshaft position sensor INFO.

NEXT ▼

13.	CHECK WHETHER DTC OUTPUT RECURS (DTC P3190, P3191 OR P3193)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTC INFO.

(e) Turn the power switch off.

(f) Turn the power switch on (IG) and turn the Techstream on.

(g) Put the engine in inspection mode INFO.

(h) Start the engine.

(i) Allow the engine to idle for 10 seconds or more.

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(j) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(k) Read the pending DTCs.

Result:

Result	Proceed to
P3190, P3191 or P3193 is output	A
DTC is not output	B

B ▶ END

A ▼

14.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode INFO.

(e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps

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-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

Result:

Result	Proceed to
Outside of standard range	A
Within standard range	B

B ▶ REPLACE ECM

A ▼

15.	INSPECT EGR VALVE ASSEMBLY

(a) Remove the EGR valve assembly INFO.

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

(c) Reinstall the EGR valve assembly INFO.

NG ▶ REPLACE EGR VALVE ASSEMBLY

OK ▼

16.	REPLACE ECM

(a) Replace the ECM INFO.

NEXT ▼

17.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

(a) Connect the Techstream to the DLC3.

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(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTC INFO.

(e) Turn the power switch off and wait for 30 seconds.

(f) Turn the power switch on (IG) and turn the Techstream on.

(g) Put the engine in inspection mode INFO.

(h) Start the engine.

(i) Allow the engine to idle for 10 seconds or more.

(j) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(k) Input the DTC: P3190, P3191 or P3193.

(l) Check the DTC judgment result.

NEXT ▶ **END**

18.	CHECK FUEL LINE

(a) Check the fuel lines for leaks or blockage.

NG ▶ REPAIR OR REPLACE FUEL LINE
OK ▶ **REPLACE FUEL PUMP**

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DTC	U0293	Lost Communication with HV ECU

MONITOR DESCRIPTION

The Controller Area Network (CAN) is a serial data communication system for real-time application. It is a multiplex communication system designed for on-vehicle use that provides a superior communication speed of 500 kbps and a capability to detect malfunctions. Through the combination of the CANH and CANL bus lines, the CAN is able to maintain communication based on differential voltage.

DTC No.	DTC Detection Condition	Trouble Area
U0293	Communication with power management control ECU is interrupted (1 trip detection logic)	• Wire harness • Power management control ECU

MONITOR STRATEGY

Related DTCs	U0293: Lost communication with power management control ECU
Required Sensors/Components (Main)	ECM
Frequency of Operation	Continuous
Duration	0.576 seconds
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

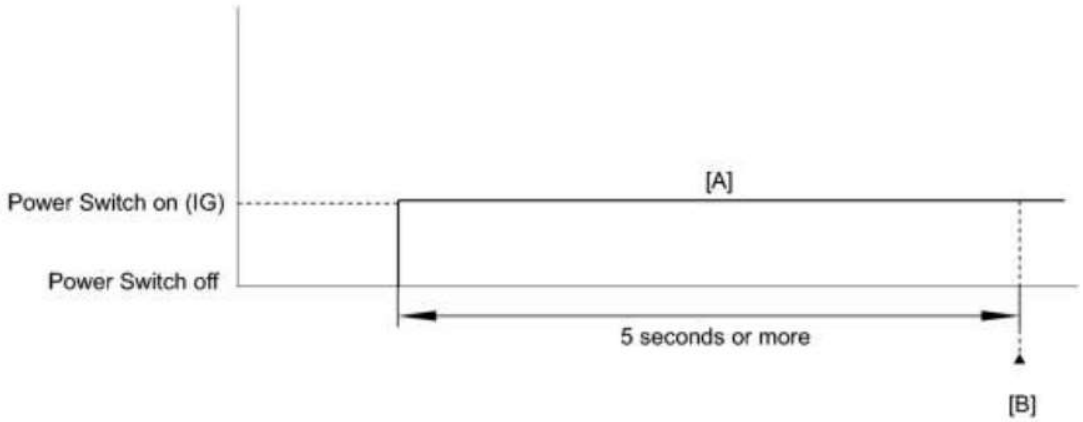
Monitor runs whenever following DTCs are not present	None
Battery Voltage	10.5 V or more (0.5 seconds or more)
Power switch	On (IG) (0.5 seconds or more)

TYPICAL MALFUNCTION THRESHOLDS

Communication signal	No signal from power management control ECU

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on.
6. Wait 5 seconds or more [A].
7. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
8. Read the DTC [B].
9. If a DTC is output, the system is malfunctioning.

   HINT:

   If a DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
11. Input the DTC: U0293.
12. Check the DTC judgment result.

Techstream Display	Description
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	○ Unable to perform DTC judgment

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Techstream Display	Description
	○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows INCOMPLETE or UNKNOWN, perform steps [B] again.

13. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
14. Check the judgment result.

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

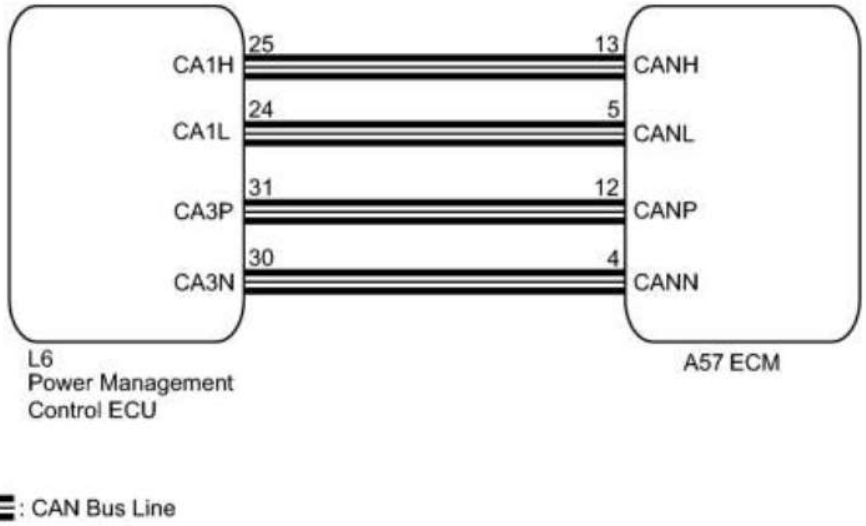
15. If the test result is INCOMPLETE or UNKNOWN and no DTC is output, perform a universal trip and check for permanent DTCs INFO.

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

Refer to the CAN Communication System INFO.

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EVAP System

RELATED DTCS

DTC	Monitoring Item	See page
P043E	Reference orifice clogged (built into canister pump module)	INFO
P043F	Reference orifice high-flow (built into canister pump module)	
P0441	• Purge VSV (Vacuum Switching Valve) stuck closed • Purge VSV stuck open • Purge flow	INFO
P0451	Canister pressure sensor (built into canister pump module) signal noise	INFO
P0452	Canister pressure sensor (built into canister pump module) voltage low	
P0453	Canister pressure sensor (built into canister pump module) voltage high	
P0455	EVAP gross leak	INFO
P0456	EVAP small leak	
P2401	Leak detection pump stuck OFF (built into canister pump module)	INFO
P2402	Leak detection pump stuck ON (built into canister pump module)	
P2419	Vent valve stuck closed (built into canister pump module)	INFO
P2420	Vent valve stuck open (vent) (built into canister pump module)	INFO
P2610	Soak timer (built into ECM)	INFO

If any EVAP system DTCs are set, the malfunctioning area can be determined using the table below.

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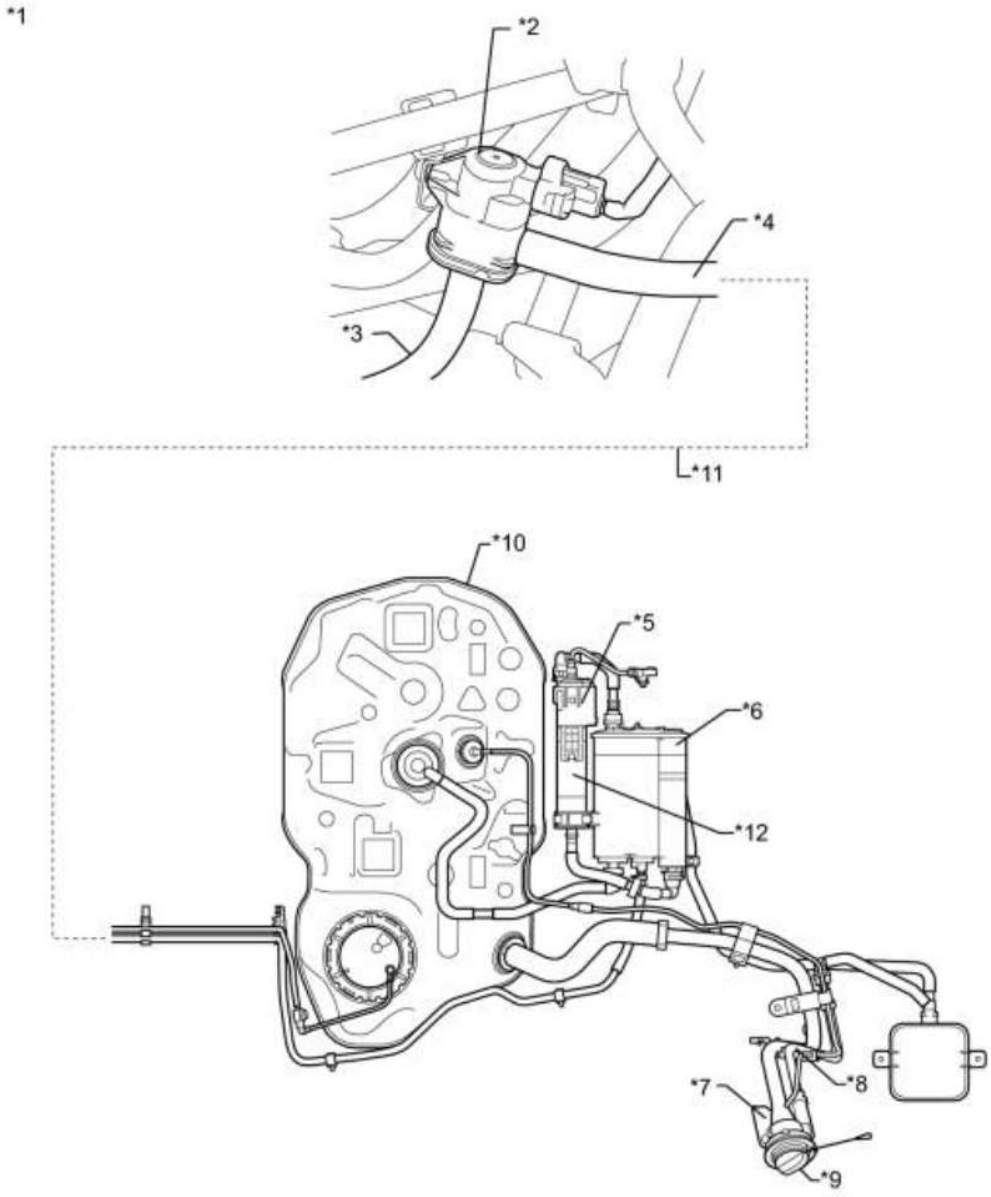
DTCs / Malfunctioning Areas	P043E P043F	P0441	P0451	P0452	P0453	P0455	P0456	P2401 P2402	P2419	P2420
Reference orifice clogged	●							●	●	
Reference orifice high-flow	●							●	●	
Purge VSV stuck open		●				●				
Purge VSV stuck closed		●								
Canister pressure sensor signal noise			●							
Canister pressure sensor low output				●						
Canister pressure sensor high output					●					
Gross leak		●				●				
Small leak							●			
Leak detection pump stuck OFF	●							●	●	
Leak detection pump stuck ON	●							●	●	
Vent valve stuck closed	●							●	●	
Vent valve stuck open (vent)										●

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NOTICE:

If the reference pressure difference between the first and second checks is greater than the specification, all the DTCs relating to the reference pressure (P043E, P043F, P2401, P2402 and P2419) are stored.

DESCRIPTION



c

Text in Illustration

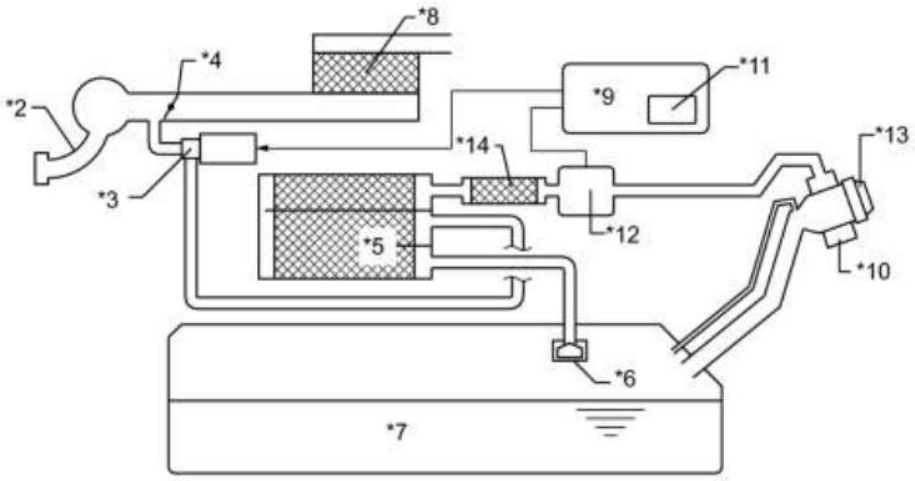
*1	Location of EVAP (Evaporative Emission) System	*2	Purge VSV
*3	EVAP Hose (to Intake Manifold)	*4	EVAP Hose (from Canister)
*5	Canister Pump Module	*6	Canister
*7	Canister Filter	*8	Air Inlet Port
*9	Fuel Cap	*10	Fuel Tank
*11	Purge Line	*12	No. 2 Canister Filter

HINT:

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The canister pressure sensor, the leak detection pump and the vent valve are built into the canister pump module.

*1



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Text in Illustration

*1	EVAP System Circuit	*2	Intake Manifold
*3	Purge VSV	*4	Throttle Valve
*5	Canister	*6	Cut-off Valve
*7	Fuel Tank	*8	Air Cleaner
*9	ECM	*10	Canister Filter
*11	Soak Timer	*12	Canister Pump Module
*13	Fuel Cap	*14	No. 2 Canister Filter

NOTICE:

In this vehicle's EVAP system, turning on the vent valve does not seal off the EVAP system. To check for leaks in the EVAP system, disconnect the air inlet vent hose and apply pressure from the atmospheric side of the canister.

While the engine is running, if a predetermined condition (closed-loop, etc.) is met, the purge VSV is opened by the ECM and stored fuel vapors in the canister are purged into the intake manifold. The ECM changes the duty cycle of the purge VSV to control purge flow volume.

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The purge flow volume is also determined by the intake manifold pressure. Atmospheric pressure is allowed into the canister through the vent valve to ensure that the purge flow is maintained when negative pressure (vacuum) is applied to the canister.

The following two monitors run to confirm the appropriate EVAP system operation.

1. Key-off monitor

This monitor checks for EVAP (evaporative emission) system leaks and canister pump module malfunctions. The monitor starts 5 hours* after the power switch is turned off. At least 5 hours are required for the fuel to cool down to stabilize the EVAP pressure, thus making the EVAP system monitor more accurate.

The leak detection pump creates negative pressure (vacuum) in the EVAP system and the pressure is measured. Finally, the ECM monitors for leaks from the EVAP system, and malfunctions in both the canister pump module and purge VSV based on the EVAP pressure.

HINT:

*: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the power switch is turned off, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the power switch is turned off, the monitor check starts 2.5 hours later.

2. Purge flow monitor

The purge flow monitor consists of the 2 monitors. The 1st monitor is conducted every time and the 2nd monitor is activated if necessary.

- The 1st monitor

  While the engine is running and the purge VSV (Vacuum Switching Valve) is on (open), the ECM monitors the purge flow by measuring the EVAP pressure change. If negative pressure is not created, the ECM begins the 2nd monitor.

- The 2nd monitor

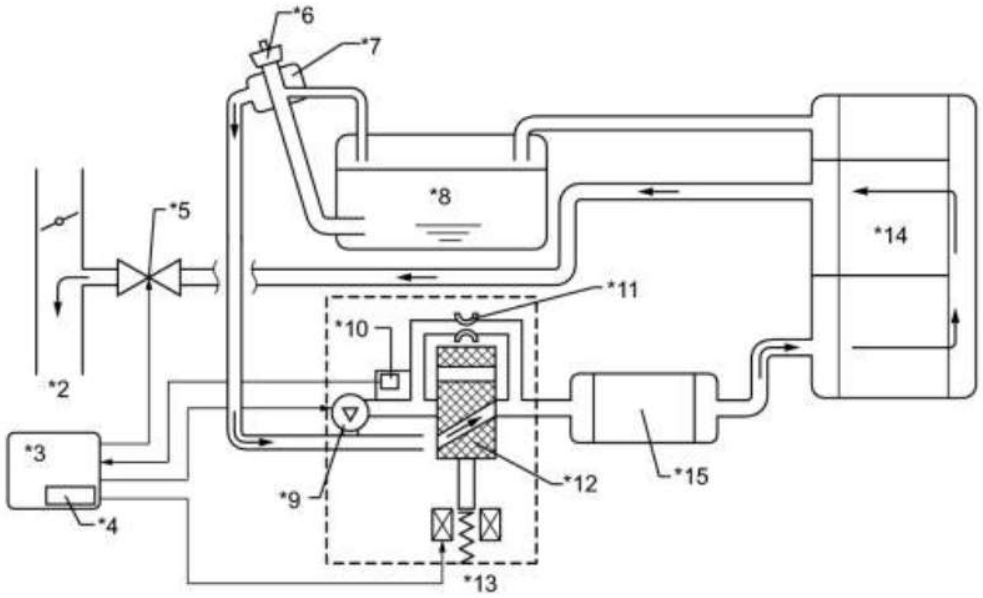
  The vent valve is turned off (open) and the EVAP pressure is measured. If the variation in the pressure is less than 0.15 kPa (1.13 mmHg), the ECM interprets this as the purge VSV being stuck closed, and illuminates the MIL and sets DTC P0441 (2 trip detection logic).

Atmospheric pressure check:

In order to ensure reliable malfunction detection, the variation between the atmospheric pressures, before and after the purge flow monitor, is measured by the ECM.

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*1



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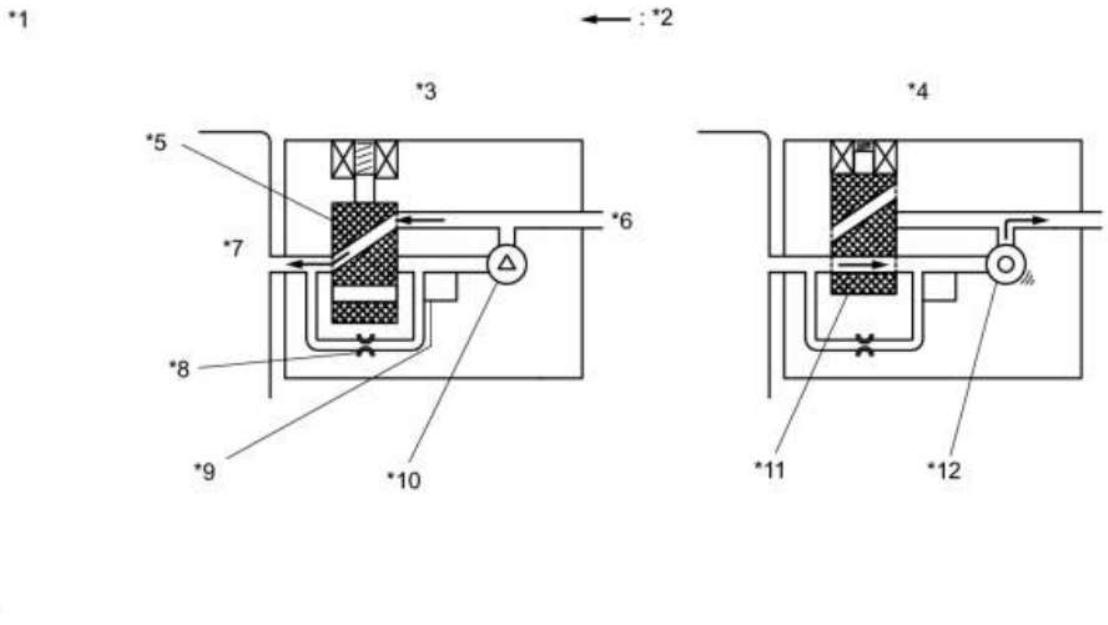
Text in Illustration

*1	EVAP Purge Flow	*2	to Intake Manifold
*3	ECM	*4	Soak Timer
*5	Purge VSV (on)	*6	Fuel Cap
*7	Canister Filter	*8	Fuel Tank
*9	Leak Detection Pump (off)	*10	Canister Pressure Sensor
*11	Reference Orifice (0.02 inch)	*12	Vent Valve (off)
*13	Canister Pump Module	*14	Canister
*15	No. 2 Canister Filter	-	-

Component	Operation
Canister	Contains activated charcoal to absorb EVAP (evaporative emissions) generated in fuel tank.
Cut-off valve	Located in fuel tank. Valve floats and closes when fuel tank is 100% full.
Purge VSV (Vacuum Switching Valve)	Opens or closes line between canister and intake manifold. ECM uses purge VSV to control EVAP purge flow. In order to discharge EVAP absorbed by canister to intake manifold, ECM opens purge VSV. EVAP discharge volume to intake manifold controlled by purge VSV duty cycle (current-carrying time) (Open: on; Closed: off).
Soak timer	Built into ECM. To ensure accurate EVAP monitor, measures 5 hours (+/-15 min) after power switch is turned off. This allows fuel to cool down, stabilizing EVAP pressure. When approximately 5 hours elapsed, ECM activates (refer to fig. 3).
Canister pump module	Consists of (a) to (d) below. Canister pump module cannot be disassembled.

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Component	Operation
(a) Vent valve	Vents and closes EVAP system. When ECM turns valve on, EVAP system is closed. When ECM turns valve off, EVAP system is vented. Negative pressure (vacuum) is created in EVAP system to check for EVAP leaks by closing purge VSV, turning on vent valve (closing it) and operating leak detection pump (refer to fig. 1).
(b) Canister pressure sensor	Indicates pressure as voltage. ECM supplies regulated 5 V to canister pressure sensor, and uses feedback from sensor to monitor EVAP system pressure (refer to fig. 2).
(c) Leak detection pump	Creates negative pressure (vacuum) in EVAP system for leak check.
(d) Reference orifice	Has opening with 0.02 inch diameter. Vacuum is produced through orifice by closing purge VSV, turning off vent valve and operating leak detection pump to monitor reference pressure. Reference pressure indicates small leak of EVAP.

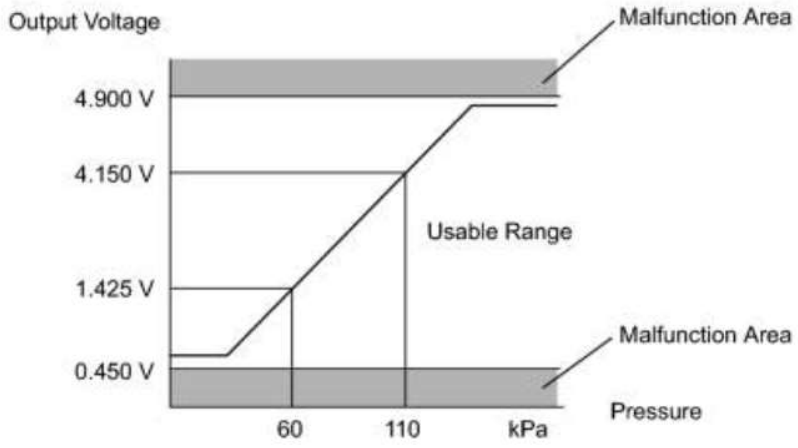


Text in Illustration

*1	Canister Pump Module (fig. 1)	*2	Airflow
*3	Condition: Purge Flow	*4	Condition: Leak Check
*5	Vent Valve: off (vent)	*6	to Canister Filter (Atmosphere)
*7	Canister	*8	Reference Orifice (0.02 Inch)
*9	Canister Pressure Sensor	*10	Leak Detection Pump: off
*11	Vent Valve: on (closed)	*12	Leak Detection Pump: on

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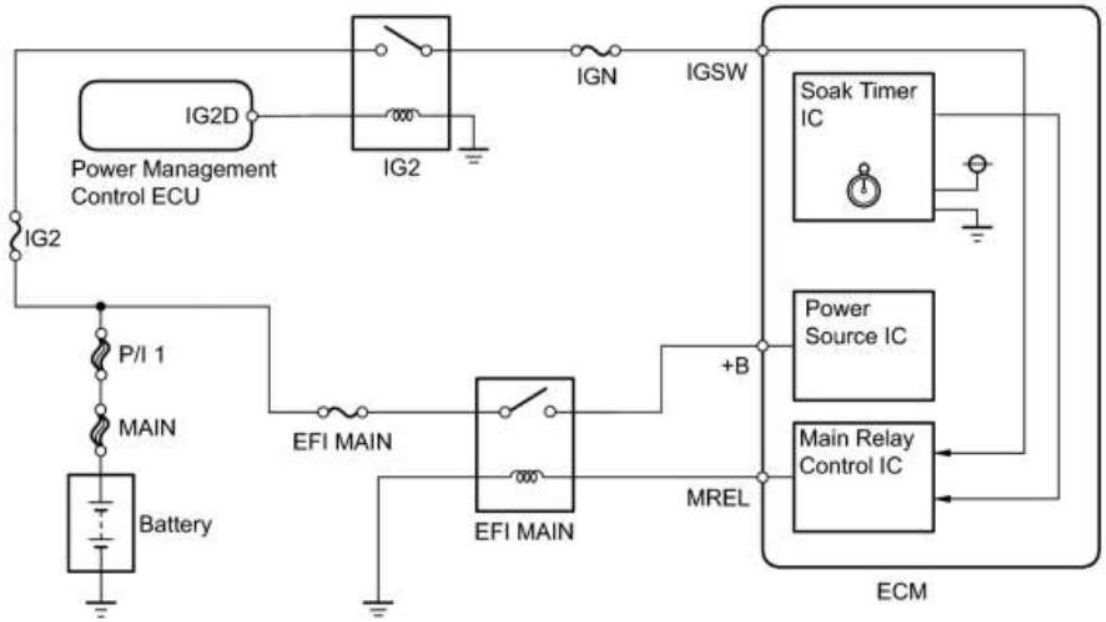
Canister Pressure Sensor Specification (fig. 2)



HINT:

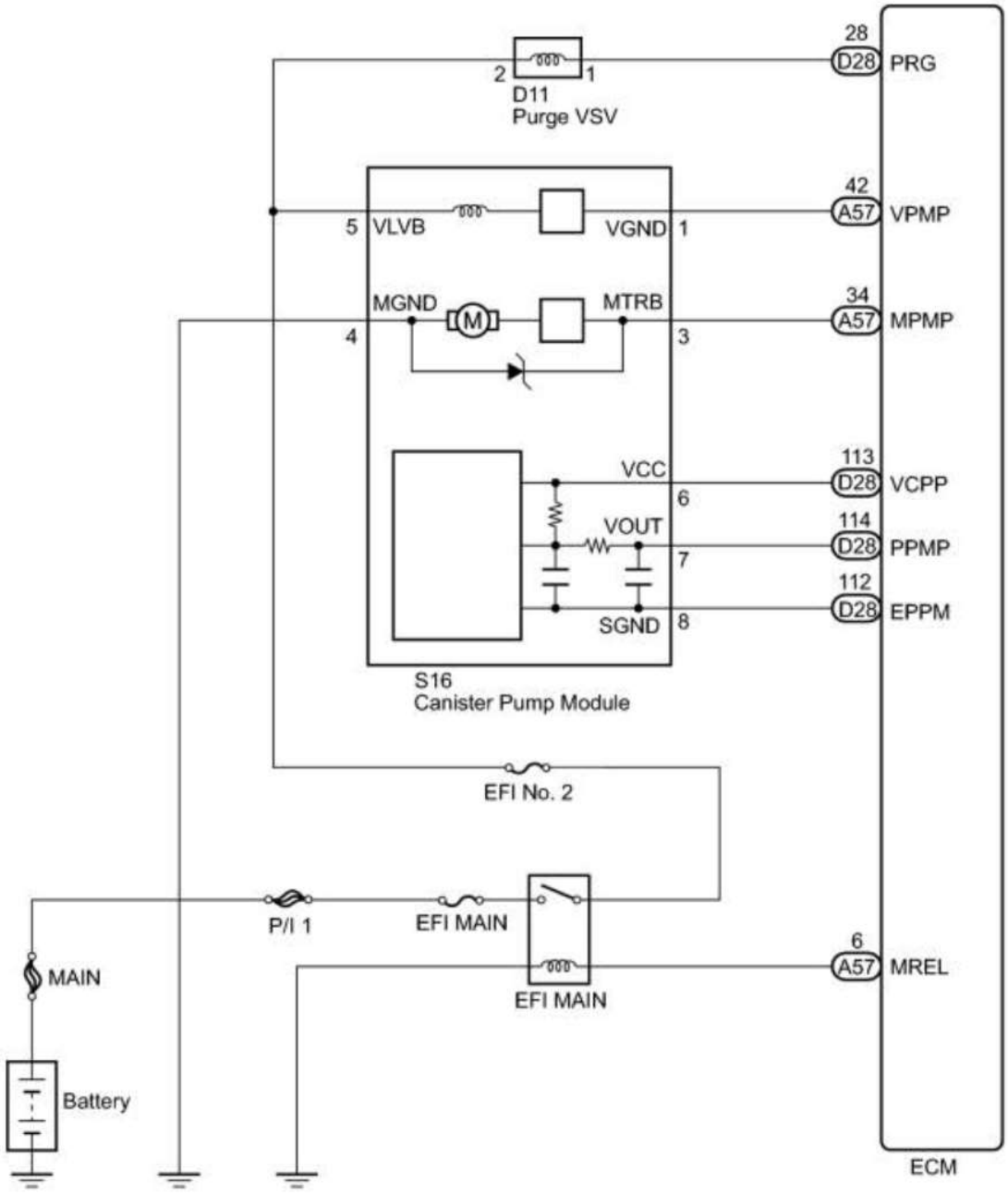
Standard atmospheric pressure is 101.3 kPa

Soak Timer Circuit (fig. 3)



WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

- Inspect the fuses for circuits related to this system before performing the following inspection procedure.
- The Techstream is required to conduct the following diagnostic troubleshooting procedure.

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HINT:

- Using Techstream monitor results enables the EVAP (evaporative emission) system to be confirmed.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	CONFIRM DTC

(a) Turn the power switch off and wait for 10 seconds.

(b) Turn the power switch on (IG).

(c) Turn the power switch off and wait for 10 seconds.

(d) Connect the Techstream to the DLC3.

(e) Turn the power switch on (IG).

(f) Turn the Techstream on.

(g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(h) Confirm DTCs and freeze frame data.

If any EVAP system DTCs are set, the malfunctioning area can be determined using the table below.

NOTICE:

If the reference pressure difference between the first and second checks is greater than the specification, all the DTCs relating to the reference pressure (P043E, P043F, P2401, P2402 and P2419) are stored.

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Malfunctioning Areas \ DTCs	P043E P043F	P0441	P0451	P0452	P0453	P0455	P0456	P2401 P2402	P2419	P2420
Reference orifice clogged	●							●	●	
Reference orifice high-flow	●							●	●	
Purge VSV stuck open		●				●				
Purge VSV stuck closed		●								
Canister pressure sensor signal noise			●							
Canister pressure sensor low output				●						
Canister pressure sensor high output					●					
Gross leak		●				●				
Small leak							●			
Leak detection pump stuck OFF	●							●	●	
Leak detection pump stuck ON	●							●	●	
Vent valve stuck closed	●							●	●	
Vent valve stuck open (vent)										●

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NEXT

2.	PERFORM EVAPORATIVE SYSTEM CHECK (AUTO OPERATION)

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 18 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F).

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Enter the following menus: Powertrain / Engine and ECT / Utility / Evaporative System Check / Automatic Mode.

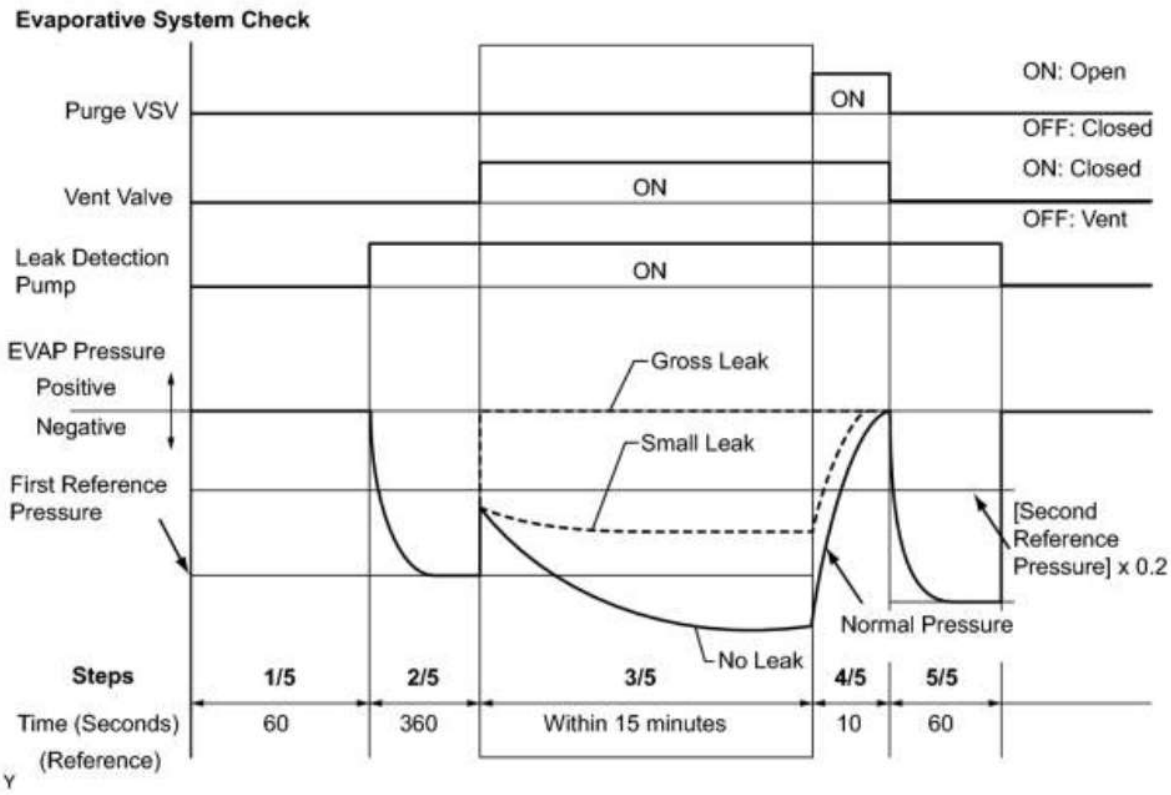
(f) After the Evaporative System Check is completed, check for pending DTCs by entering the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

HINT:

If no pending DTCs are displayed, perform the Monitor Confirmation (see "Diagnostic Help" menu). After this confirmation, check for pending DTCs. If no DTCs are displayed, the EVAP system is normal.

NEXT

3.	PERFORM EVAPORATIVE SYSTEM CHECK (MANUAL OPERATION)



NOTICE:

- In the Evaporative System Check (Manual Mode), perform the series of 5 Evaporative System Check steps manually using the Techstream.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.

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- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F).

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

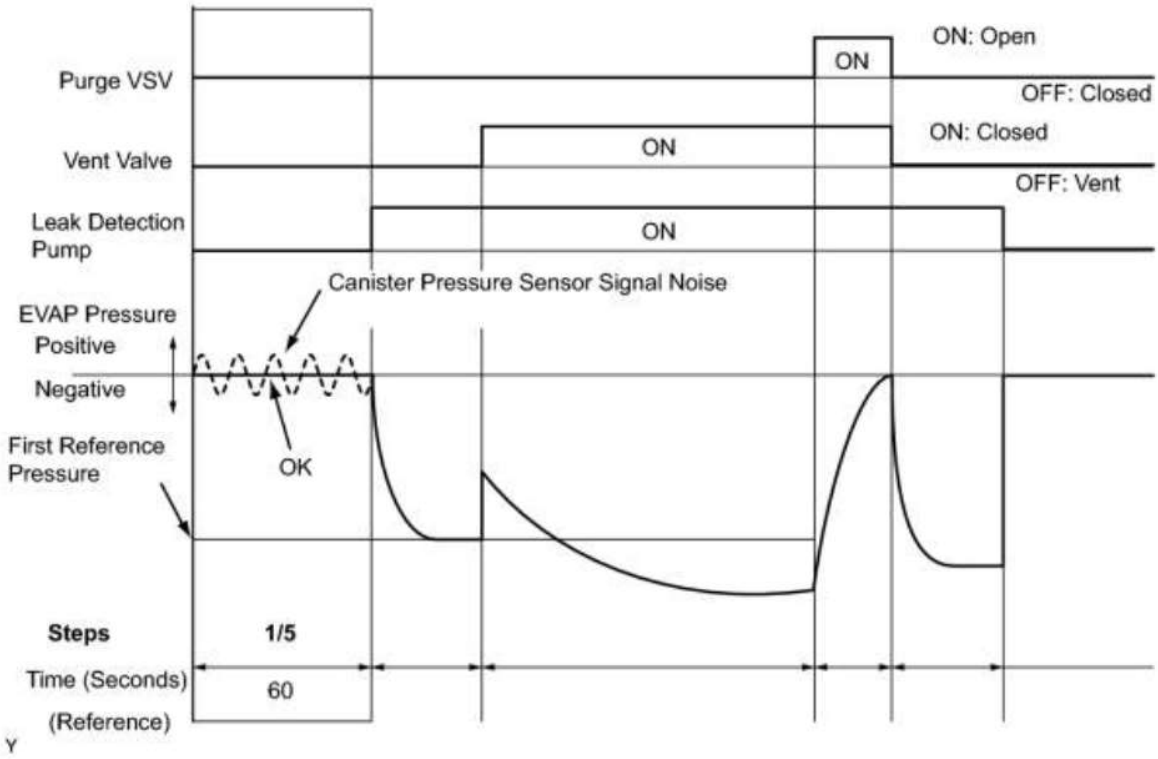
(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Enter the following menus: Powertrain / Engine and ECT / Utility / Evaporative System Check / Manual Mode.

NEXT

4.	PERFORM EVAPORATIVE SYSTEM CHECK (STEP 1/5)



(a) Check the EVAP pressure in step 1/5.

Result:

DTC*	Test Result	Suspected Trouble Area	Proceed to
-	Virtually no variation in EVAP pressure	Not yet determined	A

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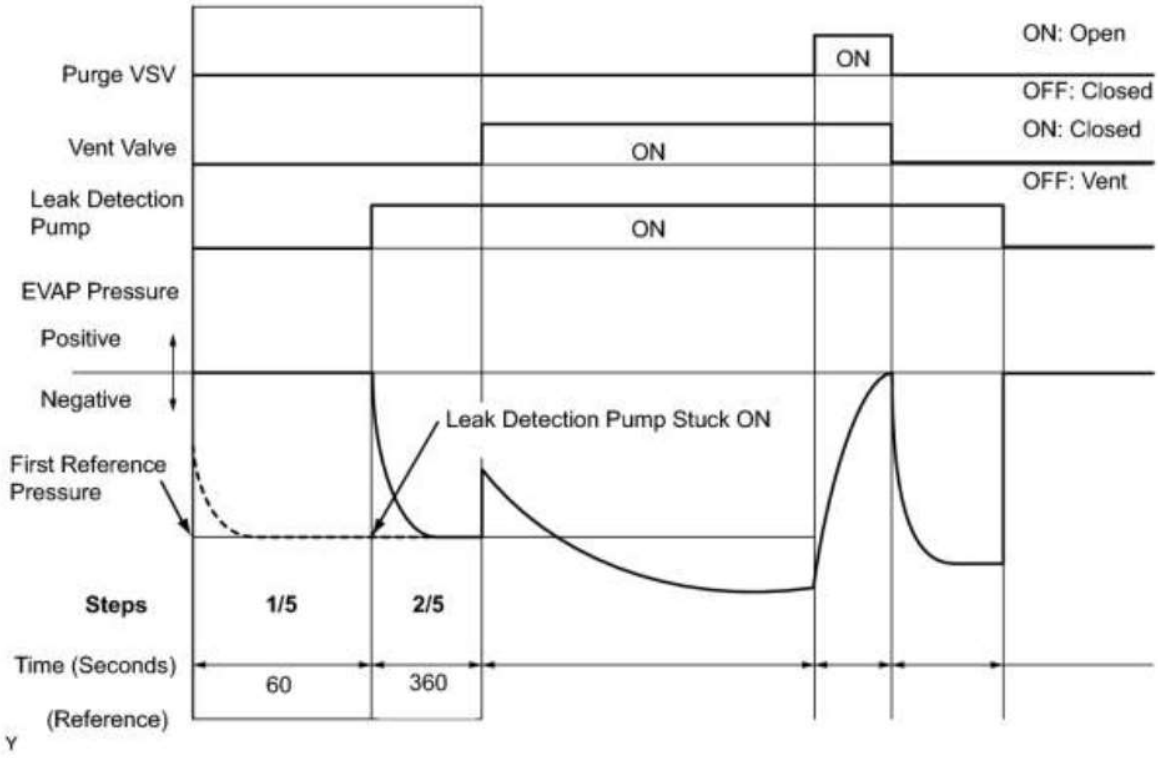
DTC*	Test Result	Suspected Trouble Area	Proceed to
P0451	EVAP pressure fluctuates by +/-0.3 kPa (2.25 mmHg) or more	Canister pressure sensor signal noise	B

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "Confirm DTC" procedure above.

B ▶ REPLACE CANISTER

A ▼

5.	PERFORM EVAPORATIVE SYSTEM CHECK (STEP 1/5 TO 2/5)



(a) Check the EVAP pressure in steps 1/5 and 2/5.

Result:

DTC*	Test Result	Suspected Trouble Area	Proceed to
-	Virtually no variation in EVAP pressure during step 1/5. Then decreases to reference pressure	Not yet determined	A
P2402	Small difference between EVAP pressures during steps 1/5 and 2/5	Leak detection pump stuck ON	B

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*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "Confirm DTC" procedure above.

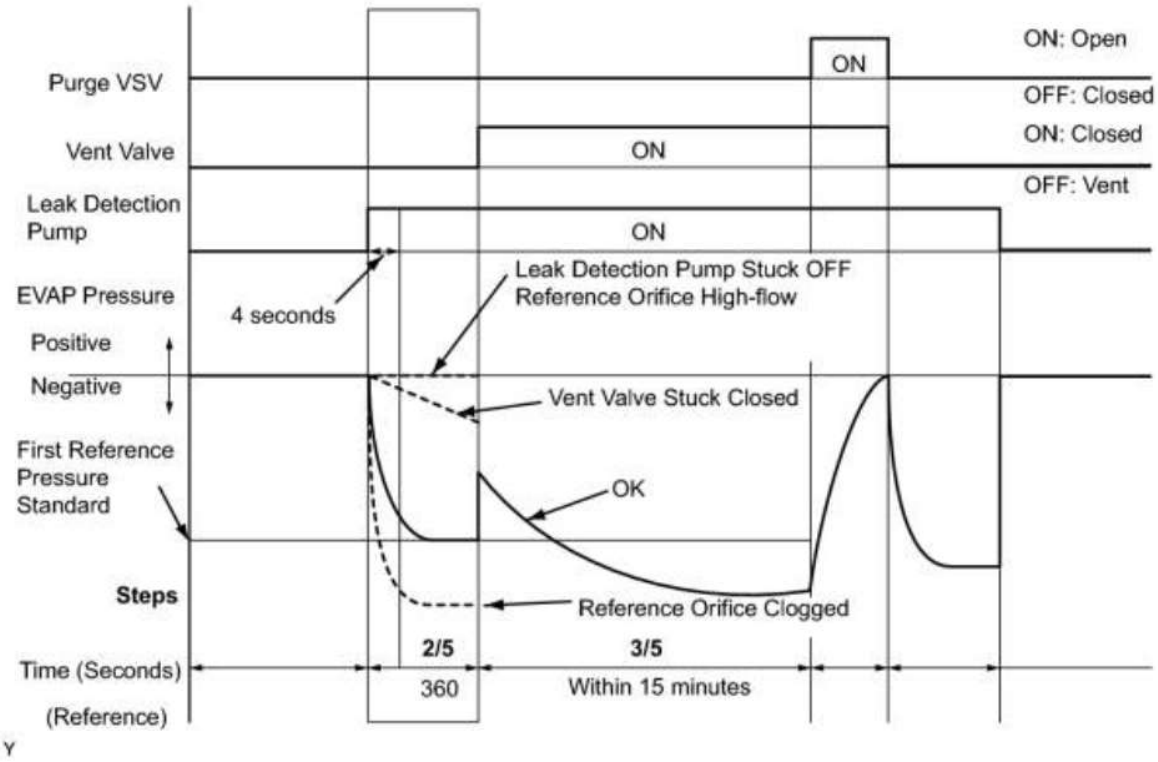
HINT:

The first reference pressure is the value determined in step 2/5.

B ▶ PERFORM ACTIVE TEST USING TECHSTREAM (ACTIVE THE VACUUM PUMP)

A ▼

6.	PERFORM EVAPORATIVE SYSTEM CHECK (STEP 2/5)



HINT:

Make a note of the pressures checked in steps A and B below.

- (a) Check the EVAP pressure 4 seconds after the leak detection pump is activated* (Step A).

*: The leak detection pump begins to operate as step 1/5 finishes and step 2/5 starts.

- (b) Check the EVAP pressure again when it has stabilized. This pressure is the reference pressure (Step B).

Result:

DTC*	Test Result	Suspected Trouble Area	Proceed to

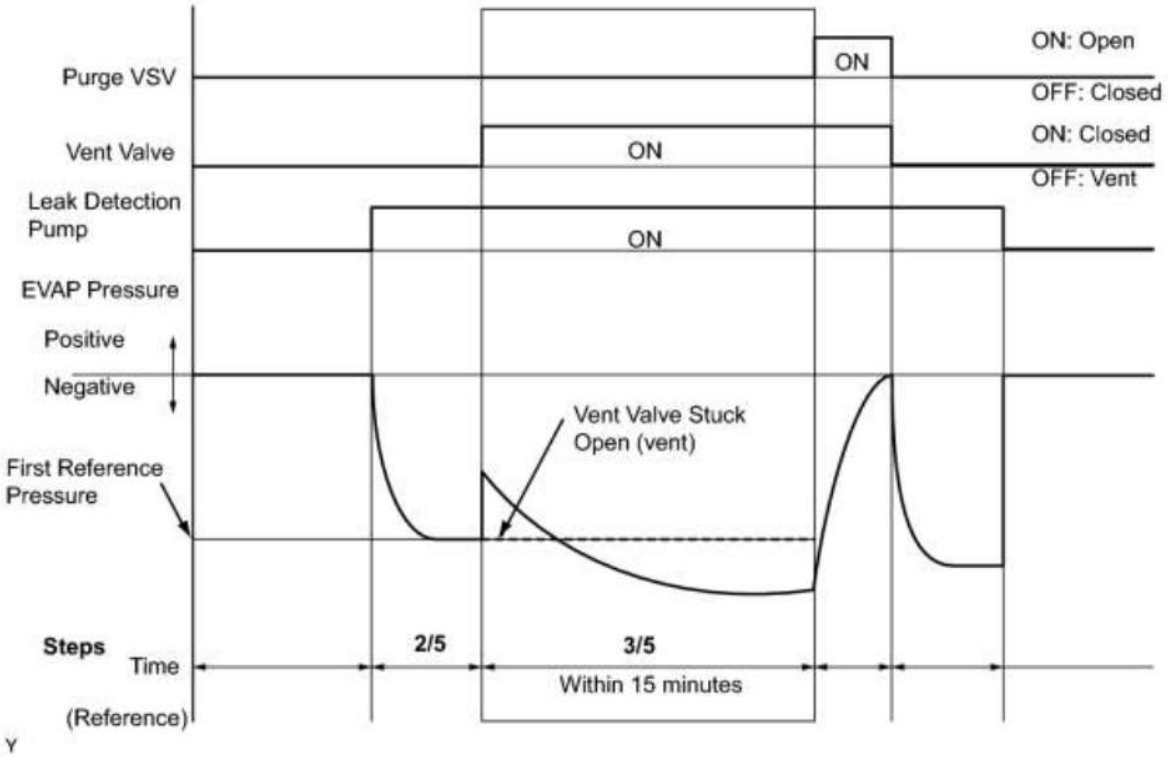
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DTC*	Test Result	Suspected Trouble Area	Proceed to
-	EVAP pressure in step B between -4.85 kPa and -1.057 kPa (-36.38 mmHg and -7.93 mmHg)	Not yet determined	A
P043F and P2401	EVAP pressure in step B -1.057 kPa (-7.93 mmHg) or more	• Reference orifice high-flow • Leak detection pump stuck OFF	B
P043E	EVAP pressure in step B below -4.85 kPa (-36.38 mmHg)	Reference orifice clogged	C
P2419	EVAP pressure in step A more than -1.057 kPa (-7.93 mmHg)	Vent valve stuck closed	D

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "Confirm DTC" procedure above.

D ▶INSPECT CANISTER PUMP MODULE (VENT VALVE OPERATION)
C ▶REPLACE CANISTER
B ▶PERFORM EVAPORATIVE SYSTEM CHECK (STEP 3/5)
A ▼

7.	PERFORM EVAPORATIVE SYSTEM CHECK (STEP 2/5 TO 3/5)



(a) Check the EVAP pressure in step 3/5.

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Result:

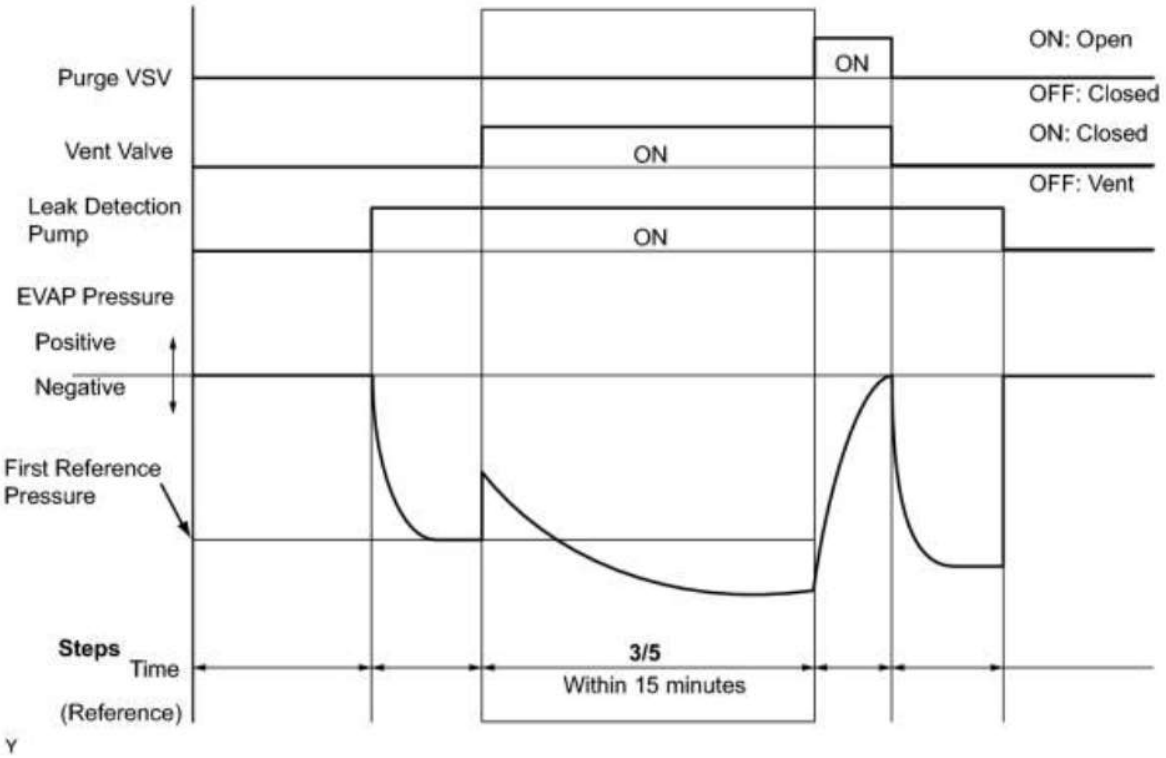
DTC*	Test Result	Suspected Trouble Area	Proceed to
-	EVAP pressure increases by 0.3 kPa (2.25 mmHg) or more within 10 seconds of proceeding from step 2/5 to step 3/5	Not yet determined	A
P2420	No variation in EVAP pressure despite proceeding from step 2/5 to step 3/5	Vent valve stuck open (vent)	B

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "Confirm DTC" procedure above.

B ▶ INSPECT CANISTER PUMP MODULE (POWER SOURCE FOR VENT VALVE)

A ▼

8.	PERFORM EVAPORATIVE SYSTEM CHECK (STEP 3/5)



(a) Wait until the EVAP pressure change is less than 0.1 kPa (0.75 mmHg) for 30 seconds.

(b) Measure the EVAP pressure and record it.

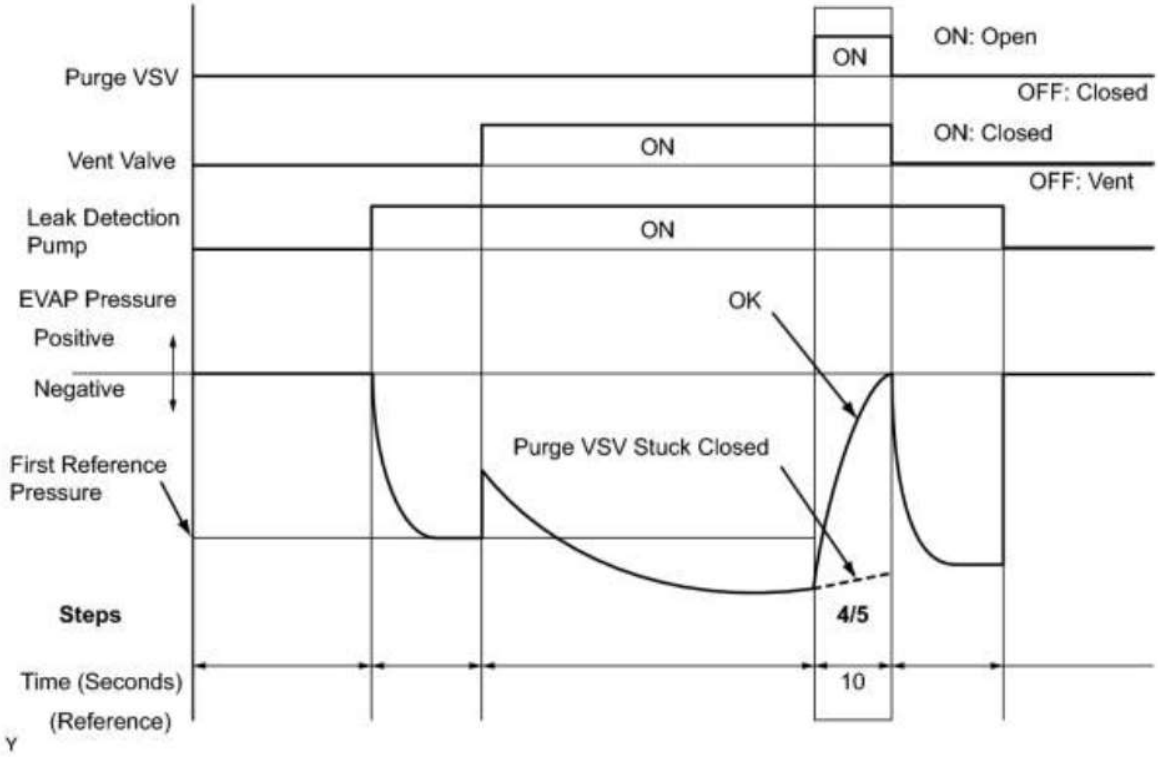
HINT:

A few minutes are required for the EVAP pressure to become saturated. When there is little fuel in the fuel tank, it takes up to 15 minutes.

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NEXT

9.	PERFORM EVAPORATIVE SYSTEM CHECK (STEP 4/5)



(a) Check the EVAP pressure in step 4/5.

Result:

DTC*	Test Result	Suspected Trouble Area	Proceed to
-	EVAP pressure increases by 0.3 kPa (2.25 mmHg) or more within 10 seconds of proceeding from step 3/5 to step 4/5	Not yet determined	A
P0441	EVAP pressure increases by 0.3 kPa (2.25 mmHg) or more within 10 seconds of proceeding from step 3/5 to step 4/5	Problems in EVAP hose between purge VSV and intake manifold	B
P0441	Variation in EVAP pressure less than 0.3 kPa (2.25 mmHg) for 10 seconds, after proceeding from step 3/5 to step 4/5	Purge VSV stuck closed	C

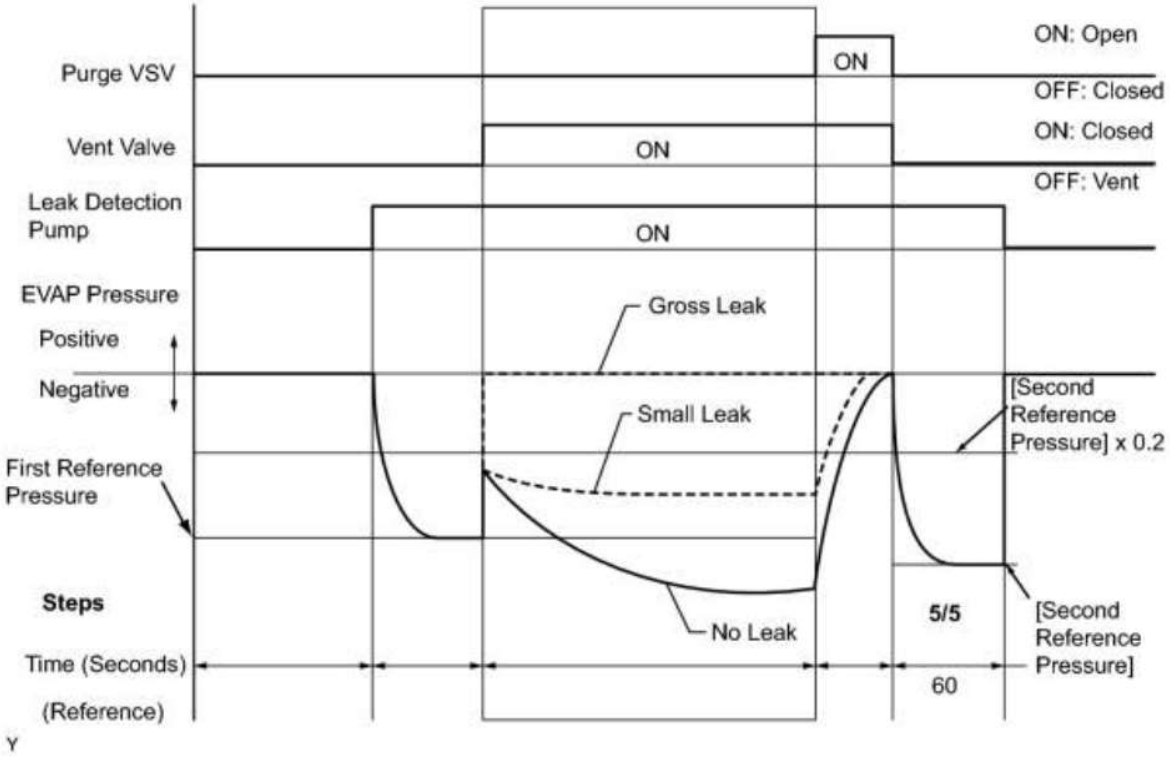
*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "Confirm DTC" procedure above.

C ▶PERFORM ACTIVE TEST USING TECHSTREAM (PURGE VSV)
B ▶CHECK EVAP HOSE (PURGE VSV - INTAKE AIR SURGE TANK ASSEMBLY)

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A

10.	PERFORM EVAPORATIVE SYSTEM CHECK (STEP 5/5)



(a) Check the EVAP pressure in step 5/5.

(b) Compare the EVAP pressure in step 3/5 and the second reference pressure (step 5/5).

Result:

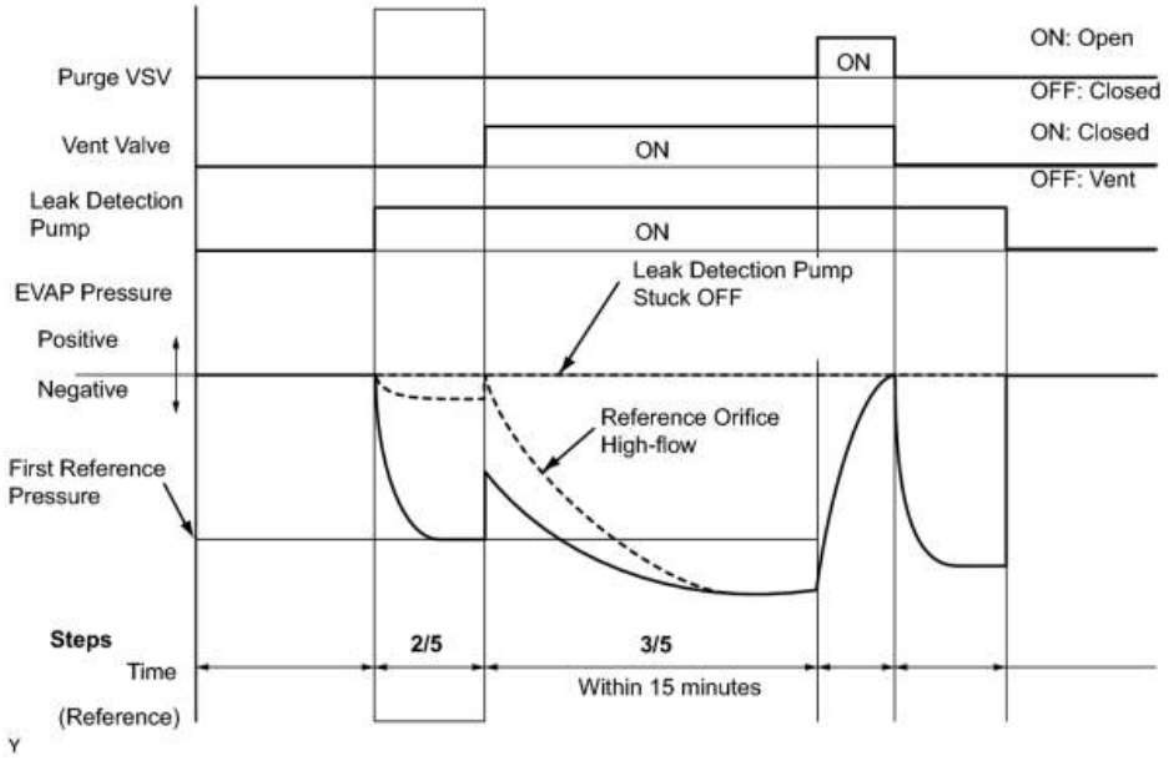
DTC*	Test Result	Suspected Trouble Area	Proceed to
-	EVAP pressure from step 3/5 lower than second reference pressure (step 5/5)	Not yet determined (no leakage from EVAP system)	A
P0441 and P0455	EVAP pressure from step 3/5 higher than [second reference pressure (step 5/5) x 0.2]	• Purge VSV stuck open • EVAP gross leak	B
P0456	EVAP pressure from step 3/5 higher than second reference pressure (step 5/5)	EVAP small leak	B

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "Confirm DTC" procedure above.

B ▶ PERFORM ACTIVE TEST USING TECHSTREAM (PURGE VSV)
A ▶ REPAIR OR REPLACE PARTS AND COMPONENTS INDICATED BY OUTPUT DTCS

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11.	PERFORM EVAPORATIVE SYSTEM CHECK (STEP 3/5)



(a) Check the EVAP pressure in step 3/5.

Result:

DTC*	Test Result	Suspected Trouble Area	Proceed to
P043F	EVAP pressure less than [reference pressure] measured in step 2/5	Reference orifice high-flow	A
P2401	EVAP pressure almost same as [reference pressure] measured in step 2/5	Leak detection pump stuck off	B

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "Confirm DTC" procedure above.

HINT:

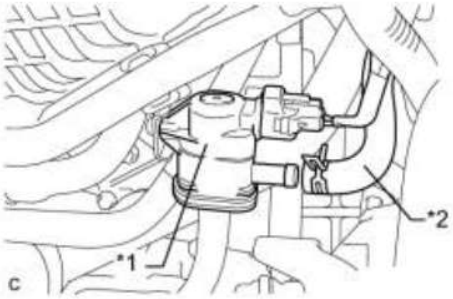
The first reference pressure is the value determined in step 2/5.

B ▶PERFORM ACTIVE TEST USING TECHSTREAM (ACTIVE THE VACUUM PUMP)
A ▶REPLACE CANISTER

12.	PERFORM ACTIVE TEST USING TECHSTREAM (PURGE VSV)

(a) Enter the following menus: Powertrain / Engine and ECT / Active Test / Activate the VSV for EVAP Control.

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(b) Disconnect the hose (connected to the canister) from the purge VSV.

Text in Illustration

*1	Purge VSV
*2	Hose (to canister)

(c) Put the engine in inspection mode INFO.

(d) Start the engine.

(e) Using the Techstream, turn off the purge VSV (Activate the VSV for Evap Control: OFF).

(f) Use your finger to confirm that the purge VSV has no suction.

(g) Using the Techstream, turn on the purge VSV (Activate the VSV for Evap Control: ON).

(h) Use your finger to confirm that the purge VSV has suction.

Result:

Test Result	Suspected Trouble Area	Proceed to
No suction when purge VSV turned off, and suction applied when turned on	Purge VSV normal	A
Suction applied when purge VSV turned off	Purge VSV stuck open	B
No suction when purge VSV turned on	• Purge VSV stuck closed • Problems with EVAP hose between purge VSV and intake manifold	C

(i) Reconnect the hose.

C ▶ CHECK EVAP HOSE (PURGE VSV - INTAKE AIR SURGE TANK ASSEMBLY)
B ▶ INSPECT PURGE VSV
A ▼

13.	CHECK FUEL TANK CAP ASSEMBLY

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(a) Check that the fuel cap is correctly installed and confirm that the fuel cap meets OEM specifications.

(b) Tighten the fuel cap until a few click sounds are heard.

HINT:

If an EVAP tester is available, check the fuel cap using the Techstream.

1. Remove the fuel cap and install it onto a fuel cap adapter.
2. Connect an EVAP tester pump hose to the adapter, and pressurize the cap to 3.2 to 3.7 kPa (24 to 28 mmHg) using an EVAP tester pump.
3. Seal the adapter and wait for 2 minutes.
4. Check the pressure. If the pressure is 2 kPa (15 mmHg) or more, the fuel cap is normal.

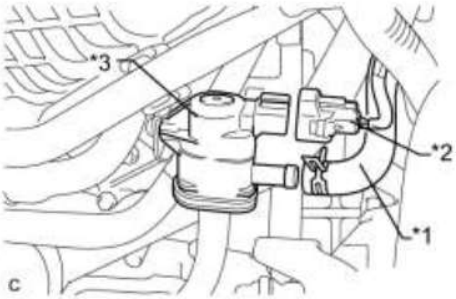
Result:

Test Result	Suspected Trouble Area	Proceed to
Fuel cap correctly installed	-	A
Fuel cap loose	• Fuel cap improperly installed • Defective fuel cap • Fuel cap does not meet OEM specifications	B
No fuel cap	-	C

(c) Reinstall the fuel cap.

C ▶REPLACE FUEL TANK CAP ASSEMBLY
B ▶CORRECTLY REINSTALL OR REPLACE FUEL TANK CAP ASSEMBLY
A ▶LOCATE EVAP LEAK PART

14.	INSPECT PURGE VSV



(a) Turn the power switch off.

(b) Disconnect the purge VSV connector.

Text in Illustration

*1	Hose (to canister)
*2	Connector
*3	Purge VSV

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(c) Disconnect the hose (connected to the canister) from the purge VSV.

(d) Turn the power switch on (IG).

(e) Put the engine in inspection mode INFO.

(f) Start the engine.

(g) Use your finger to confirm that the purge VSV has no suction.

Result:

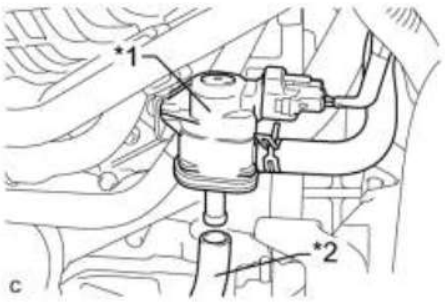
Test Result	Suspected Trouble Area	Proceed to
No suction	ECM	A
Suction applied	Purge VSV	B

(h) Reconnect the purge VSV connector.

(i) Reconnect the hose.

B ▶REPLACE PURGE VSV
A ▶REPLACE ECM

15.	CHECK EVAP HOSE (PURGE VSV - INTAKE AIR SURGE TANK ASSEMBLY)



(a) Disconnect the hose (connected to the intake manifold sub-assembly) from the purge VSV.

Text in Illustration

*1	Purge VSV
*2	Hose (to Intake Manifold Sub-assembly)

(b) Put the engine in inspection mode INFO.

(c) Start the engine.

(d) Use your finger to confirm that the hose has suction.

Result:

Test Result	Suspected Trouble Area	Proceed to
Suction applied	EVAP hose between purge VSV and intake air surge tank assembly normal	A
No suction	• Intake manifold port • EVAP hose between purge VSV and intake manifold sub-assembly	B

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(e) Reconnect the hose.

B ▶INSPECT INTAKE MANIFOLD (EVAP PURGE PORT)

A ▼

16.	INSPECT PURGE VSV

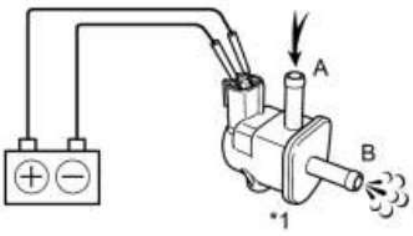
(a) Remove the purge VSV.

(b) Apply battery voltage to the terminals of the purge VSV.

Text in Illustration

*1	Purge VSV

(c) Using an air gun, confirm that air flows from port A to port B.



Result:

Test Result	Condition	Suspected Trouble Area	Proceed to
Air flows	Battery voltage is applied to purge VSV terminals	Purge VSV normal	A
No air flow	Battery voltage is applied to purge VSV terminals	Purge VSV	B

(d) Install the purge VSV.

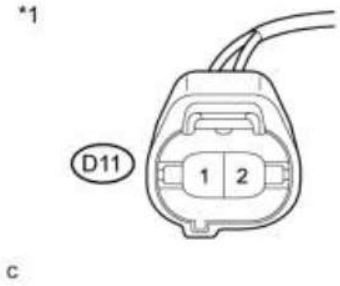
B ▶REPLACE PURGE VSV

A ▼

17.	CHECK HARNESS AND CONNECTOR (POWER SOURCE OF PURGE VSV)

(a) Disconnect the purge VSV connector.

(b) Turn the power switch on (IG).



(c) Measure the voltage according to the value(s) in the table below.

Text in Illustration

*1	Front view of wire harness connector (to Purge VSV)

Result:

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Tester Connection	Switch Condition	Specified Condition	Suspected Trouble Area	Proceed to
D11-2 - Body ground	Power switch on (IG)	11 to 14 V	Normal	A
		Other than result above	Wire harness or connectors between purge VSV and ECM	B

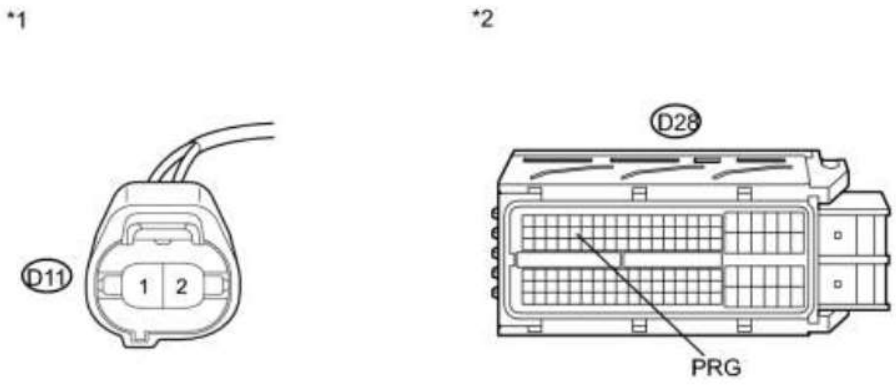
(d) Reconnect the purge VSV connector.

B ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

A ▼

18.	CHECK HARNESS AND CONNECTOR (PURGE VSV - ECM)

(a) Disconnect the ECM connector and the purge VSV connector.



(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D11-1 - D28-28 (PRG)	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D11-1 or D28-28 (PRG) - Body ground	Always	10 kΩ or higher

Text in Illustration

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*1	Front view of wire harness connector (to Purge VSV)	*2	Front view of wire harness connector (to ECM)

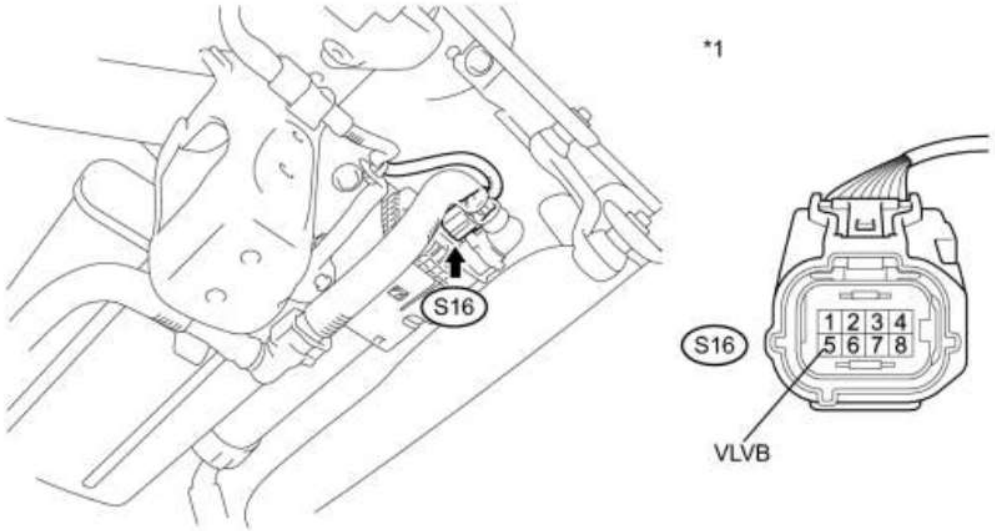
(c) Reconnect the purge VSV connector.

(d) Reconnect the ECM connector.

NG ▶REPAIR OR REPLACE HARNESS OR CONNECTOR
OK ▶REPLACE ECM

19.	INSPECT CANISTER PUMP MODULE (POWER SOURCE FOR VENT VALVE)

(a) Turn the power switch off.



c

(b) Disconnect the canister pump module connector.

(c) Turn the power switch on (IG).

(d) Measure the voltage according to the value(s) in the table below.

Result:

Tester Connection	Switch Condition	Specified Condition	Suspected Trouble Area	Proceed to
S16-5 (VLVB) - Body ground	Power switch on (IG)	11 to 14 V	1. Wire harness between vent valve and ECM 2. Vent valve 3. ECM	A

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Tester Connection	Switch Condition	Specified Condition	Suspected Trouble Area	Proceed to
		Below 3 V	Power source wire harness of vent valve	B

Text in Illustration

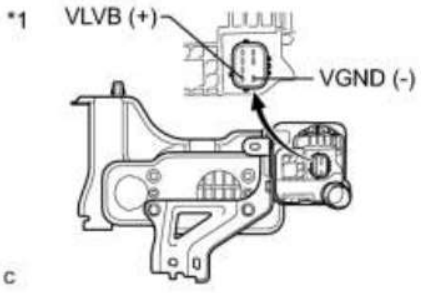
*1	Front view of wire harness connector (to Canister Pump Module)

(e) Reconnect the canister pump module connector.

B ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

A ▼

20.	INSPECT CANISTER PUMP MODULE (VENT VALVE OPERATION)



(a) Turn the power switch off.

(b) Disconnect the canister pump module connector.

(c) Apply battery voltage to the VLVB and VGND terminals of the canister pump module.

(d) Touch the canister pump module to confirm the vent valve operation.

Text in Illustration

*1	Component without harness connected (Canister Pump Module)

Result:

Condition	Test Result	Suspected Trouble Area	Proceed to
Apply battery voltage to terminals S16-5 (VLVB) and S16-1 (VGND)	Operating	1. Wire harness between vent valve and ECM 2. ECM	A

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Condition	Test Result	Suspected Trouble Area	Proceed to
	Not operating	Vent valve	B

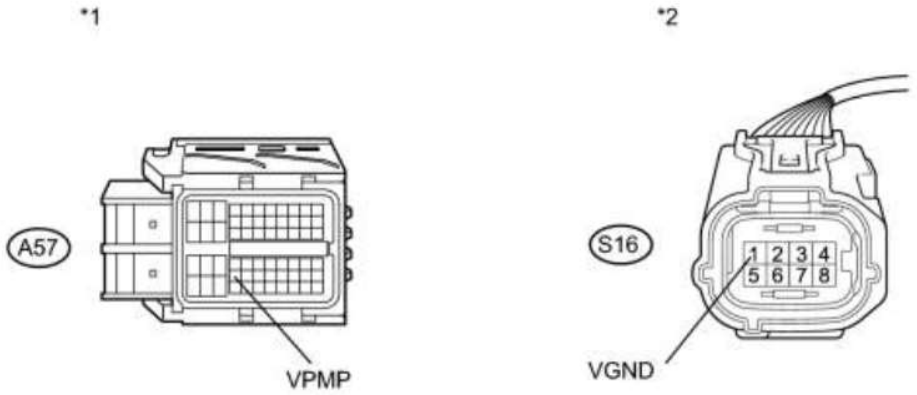
(e) Reconnect the canister pump module connector.

B ▶ REPLACE CANISTER

A ▼

21.	CHECK HARNESS AND CONNECTOR (ECM - CANISTER PUMP MODULE)

(a) Disconnect the ECM connector.



(b) Disconnect the canister pump module connector.

(c) Measure the resistance according to the value(s) in the table below.

Result:

Tester Connection	Condition	Test Result	Suspected Trouble Area	Proceed to
A57-42 (VPMP) - S16-1 (VGND)	Always	Below 1 Ω	ECM	A
		10 kΩ or higher	Wire harness between ECM and canister pump module	B

Text in Illustration

*1	Front view of wire harness connector (to ECM)	*2	Front view of wire harness connector (to Canister Pump Module)

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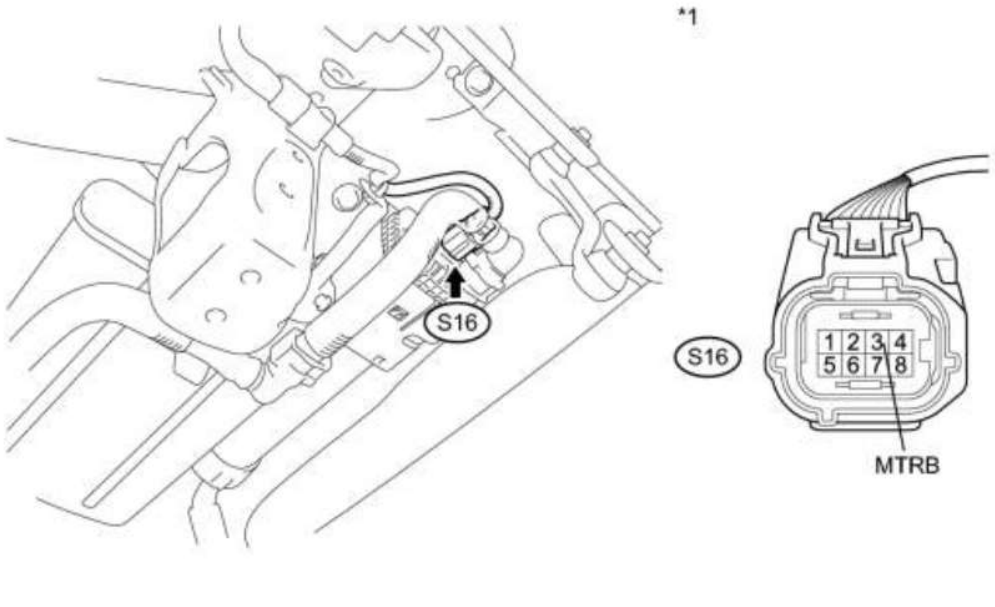
(d) Reconnect the ECM connector.

(e) Reconnect the canister pump module connector.

B REPAIR OR REPLACE HARNESS OR CONNECTOR
A REPLACE ECM

22.	PERFORM ACTIVE TEST USING TECHSTREAM (ACTIVE THE VACUUM PUMP)

(a) Turn the power switch off.



c

(b) Disconnect the canister pump module connector.

(c) Turn the power switch on (IG).

(d) Enter the following menus: Powertrain / Engine / Active Test / Activate the Vacuum Pump.

(e) Measure the voltage according to the value(s) in the table below.

Result:

Tester Connection	Condition	Test Result	Suspected Trouble Area	Proceed to
S16-3 (MTRB) - Body ground	Leak detection pump on and off (Active Test ON and OFF)	Below 3 V when OFF 11 to 14 V when ON	1. Wire harness between leak detection pump and body ground 2. Leak detection pump	A
		Below 3 V when OFF and ON	1. Wire harness between leak detection pump and ECM	B

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Tester Connection	Condition	Test Result	Suspected Trouble Area	Proceed to
			2. ECM	
		11 to 14 V when OFF and ON	ECM	C

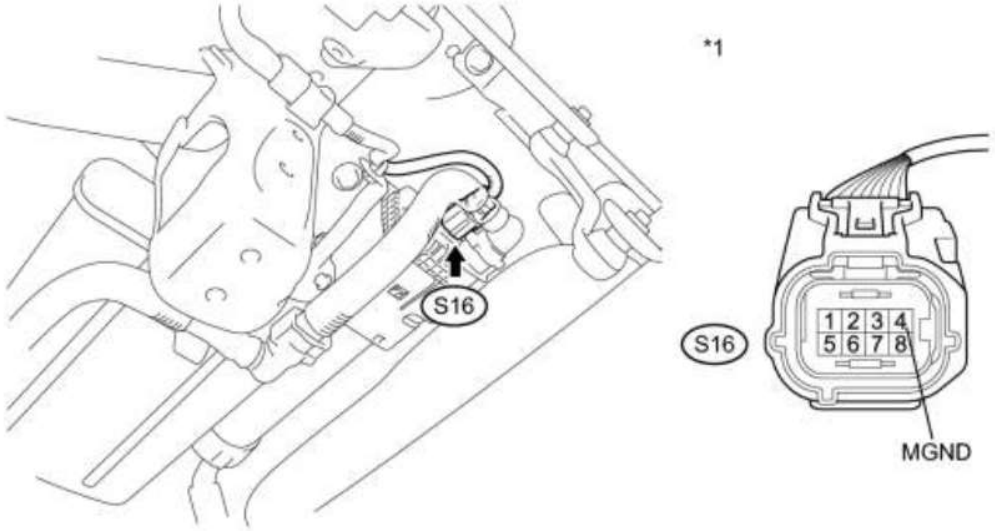
Text in Illustration

*1	Front view of wire harness connector (to Canister Pump Module)	-	-

C ▶REPLACE ECM
B ▶CHECK HARNESS AND CONNECTOR (ECM - CANISTER PUMP MODULE)
A ▼

23.	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - BODY GROUND)

(a) Turn the power switch off.



c

(b) Disconnect the canister pump module connector.

(c) Measure the resistance according to the value(s) in the table below.

Result:

Tester Connection	Condition	Specified Condition	Suspected Trouble Area	Proceed to

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Tester Connection	Condition	Specified Condition	Suspected Trouble Area	Proceed to
S16-4 (MGND) - Body ground	Always	Below 1 Ω	Leak detection pump	A
		10 kΩ or higher	Wire harness between canister pump module and body ground	B

Text in Illustration

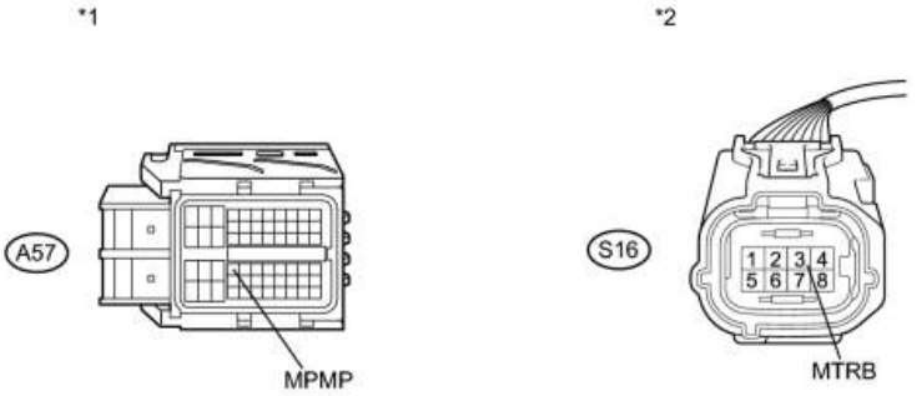
*1	Front view of wire harness connector (to Canister Pump Module)	-	-

(d) Reconnect the canister pump module connector.

B ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR
A ▶ REPLACE CANISTER

24.	CHECK HARNESS AND CONNECTOR (ECM - CANISTER PUMP MODULE)

(a) Turn the power switch off.



(b) Disconnect the canister pump module connector.

(c) Disconnect the ECM connector.

(d) Measure the resistance according to the value(s) in the table below.

Result:

Tester Connection	Condition	Test Result	Suspected Trouble Area	Proceed to
A57-34 (MPMP) - S16-3 (MTRB)	Always	Below 1 Ω	ECM	A
		10 kΩ or	Wire harness between ECM and canister	B

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Tester Connection	Condition	Test Result	Suspected Trouble Area	Proceed to
		higher	pump module	

Text in Illustration

*1	Front view of wire harness connector (to ECM)	*2	Front view of wire harness connector (to Canister Pump Module)

(e) Reconnect the canister pump module connector.

(f) Reconnect the ECM connector.

B ▶REPAIR OR REPLACE HARNESS OR CONNECTOR
A ▶REPLACE ECM

25.	INSPECT INTAKE MANIFOLD (EVAP PURGE PORT)

(a) Stop the engine.

(b) Disconnect the EVAP hose from the intake manifold.

(c) Put the engine in inspection mode INFO.

(d) Start the engine.

(e) Use your finger to confirm that the port of the intake manifold has suction.

Result:

Test Result	Suspected Trouble Area	Proceed to
Suction applied	EVAP hose between intake manifold and purge VSV	A
No suction	Intake manifold	B

(f) Reconnect the EVAP hose.

B ▶INSPECT INTAKE MANIFOLD (EVAP PURGE PORT)
A ▶REPLACE EVAP HOSE (INTAKE AIR SURGE TANK ASSEMBLY - PURGE VSV)

26.	CORRECTLY REINSTALL OR REPLACE FUEL TANK CAP ASSEMBLY

HINT:

- When reinstalling the fuel cap, tighten it until a few click sounds are heard.
- When replacing the fuel cap, use a fuel cap that meets OEM specifications, and install it until a few click sounds are heard.

NEXT ▶PERFORM EVAPORATIVE SYSTEM CHECK (AUTO OPERATION)

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27.	REPLACE FUEL TANK CAP ASSEMBLY

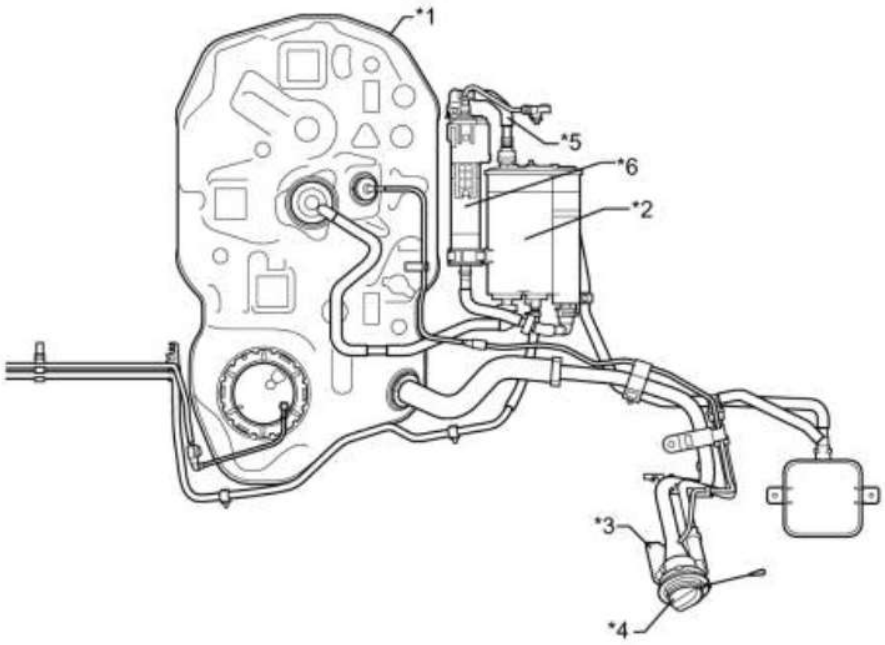
HINT:

When installing the fuel cap, tighten it until a few click sounds are heard.

NEXT ▶PERFORM EVAPORATIVE SYSTEM CHECK (AUTO OPERATION)

28.	LOCATE EVAP LEAK PART

(a) Disconnect the vent hose.

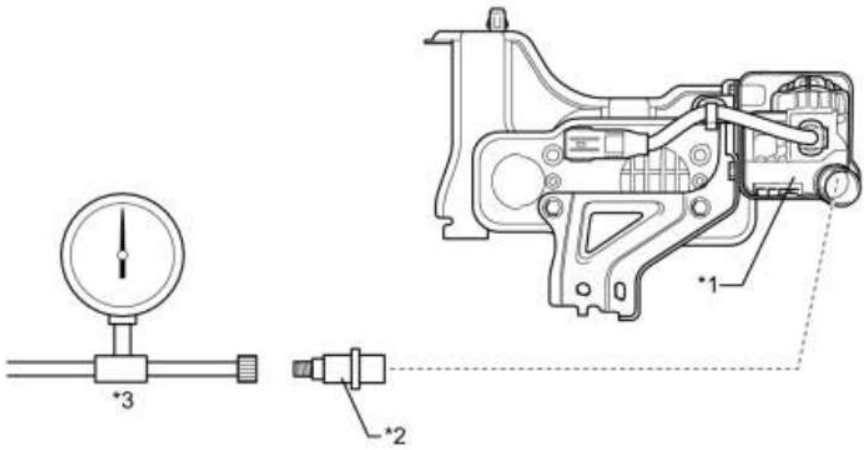


Text in Illustration

*1	Fuel Tank	*2	Canister
*3	Canister Filter	*4	Fuel Cap
*5	Disconnect the vent hose here	*6	No. 2 Canister Filter

(b) Connect the EVAP pressure tester tool to the canister pump module with the adapter.

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C

Text in Illustration

*1	Canister Pump Module	*2	Adapter
*3	EVAP Pressure Tester Tool	-	-

(c) Pressurize the EVAP system to 3.2 to 3.7 kPa (24 to 28 mmHg).

(d) Apply soapy water to the piping and connecting parts of the EVAP system.

(e) Look for areas where bubbles appear. This indicates the leak point.

(f) Repair or replace the leak point.

HINT:

Disconnect the hose between the canister and fuel tank from the canister. Block the canister side and conduct an inspection. In this way, the fuel tank can be excluded as an area suspected of causing fuel leaks.

NEXT ▶ PERFORM EVAPORATIVE SYSTEM CHECK (AUTO OPERATION)

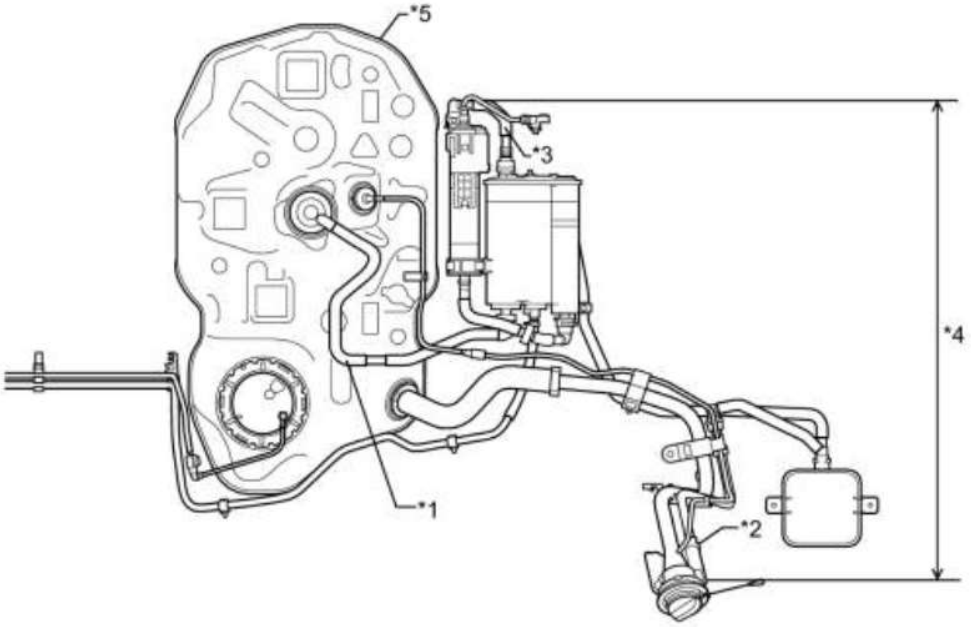
29.	REPLACE CANISTER

(a) Replace the canister INFO.

NOTICE:

When replacing the canister, check the canister pump module interior and related pipes for water, fuel and other liquids. If liquids are present, check for disconnections and/or cracks in the following: 1) the pipe from the air inlet port to the canister pump module; 2) the canister filter; and 3) the fuel tank vent hose.

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Text in Illustration

*1	Fuel Tank Vent Hose	*2	Air Inlet Port
*3	Vent Hose	*4	Inspection Area (check for disconnection and/or cracks)
*5	Fuel Tank	-	-

NEXT PERFORM EVAPORATIVE SYSTEM CHECK (AUTO OPERATION)

30.	REPLACE PURGE VSV

Replace the purge VSV INFO.

NEXT PERFORM EVAPORATIVE SYSTEM CHECK (AUTO OPERATION)

31.	REPAIR OR REPLACE HARNESS OR CONNECTOR

NEXT PERFORM EVAPORATIVE SYSTEM CHECK (AUTO OPERATION)

32.	REPLACE EVAP HOSE (INTAKE AIR SURGE TANK ASSEMBLY - PURGE VSV)

NEXT PERFORM EVAPORATIVE SYSTEM CHECK (AUTO OPERATION)

33.	INSPECT INTAKE MANIFOLD (EVAP PURGE PORT)

(a) Check that the EVAP purge port of the intake manifold is not clogged. If necessary, replace the intake manifold.

NEXT PERFORM EVAPORATIVE SYSTEM CHECK (AUTO OPERATION)

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34.	REPLACE ECM

(a) Replace the ECM INFO.

NEXT ▶PERFORM EVAPORATIVE SYSTEM CHECK (AUTO OPERATION)

35.	REPAIR OR REPLACE PARTS AND COMPONENTS INDICATED BY OUTPUT DTCS

(a) Repair the malfunctioning areas indicated by the DTCs that had been confirmed when the vehicle was brought in.

NEXT ▼

36.	PERFORM EVAPORATIVE SYSTEM CHECK (AUTO OPERATION)

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 18 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine in this step.
- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing an Evaporative System Check, keep the fuel temperature below 35°C (95°F).

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTCs INFO.

(e) Enter the following menus: Powertrain / Engine and ECT / Utility / Evaporative System Check / Automatic Mode.

(f) After the Evaporative System Check is completed, check for pending DTCs by entering the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

HINT:

If no pending DTCs are found, the repair has been successfully completed.

NEXT ▶**COMPLETED**

CONFIRMATION DRIVING PATTERN

HINT:

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After a repair, check Monitor Status by performing the Key-Off Monitor Confirmation and Purge Flow Monitor Confirmation described below.

1. KEY-OFF MONITOR CONFIRMATION

(a) Preconditions

The monitor will not run unless:

- The vehicle has been driven for 10 minutes or more (in a city area or on a freeway).
- The fuel tank is less than 90% full.
- The altitude is less than 7875 ft. (2400 m).
- The engine coolant temperature is between 4.4°C and 35°C (40°F and 95°F).
- The intake air temperature is between 4.4°C and 35°C (40°F and 95°F).
- The vehicle remains stationary (the vehicle speed is 0 mph [0 km/h]).

(b) Monitor Conditions

1. Put the engine in inspection mode INFO.
2. Allow the engine to idle for at least 5 minutes.
3. Turn the power switch off and wait for 6 hours (8 or 10.5 hours).

   HINT:

   Do not start the engine until checking Monitor Status. If the engine is started, the steps described above must be repeated.

(c) Monitor Status

1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG).
3. Turn the Techstream on.
4. Enter the following menus: Powertrain / Engine and ECT / Monitor / Evaporative System.
5. Check the Monitor Status displayed on the Techstream.

   HINT:

   If Incomplete is displayed, the monitor did not complete. Make sure that the preconditions have been met, and perform the Monitor Conditions again.

2. PURGE FLOW MONITOR CONFIRMATION (P0441)

HINT:

Perform this monitor confirmation after the Key-Off Monitor Confirmation shows Complete.

(a) Preconditions

The monitor will not run unless:

- The vehicle has been driven for 10 minutes or more (in a city area or on a freeway).

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- The engine coolant temperature is between 4.4°C and 35°C (40°F and 95°F).
- The intake air temperature is between 4.4°C and 35°C (40°F and 95°F).

(b) Monitor Conditions

1. Release the pressure from the fuel tank by removing and reinstalling the fuel cap.
2. Put the engine in inspection mode INFO.
3. Warm the engine up until the engine coolant temperature reaches more than 75°C (167°F).
4. Increase the engine speed to 2500 rpm once.
5. Allow the engine to idle and turn the A/C switch on for 1 minute.

(c) Monitor Status

1. Turn the power switch off (if on (IG) or if the engine is running).
2. Connect the Techstream to the DLC3.
3. Turn the power switch on (IG).
4. Turn the Techstream on.
5. Enter the following menus: Powertrain / Engine and ECT / Monitor / Evaporative System.
6. Check the Monitor Status displayed on the Techstream.

   HINT:

   If Incomplete is displayed, the monitor did not complete. Make sure that the preconditions have been met, and perform the Monitor Conditions again.

MONITOR RESULT

Refer to Checking Monitor Status INFO.

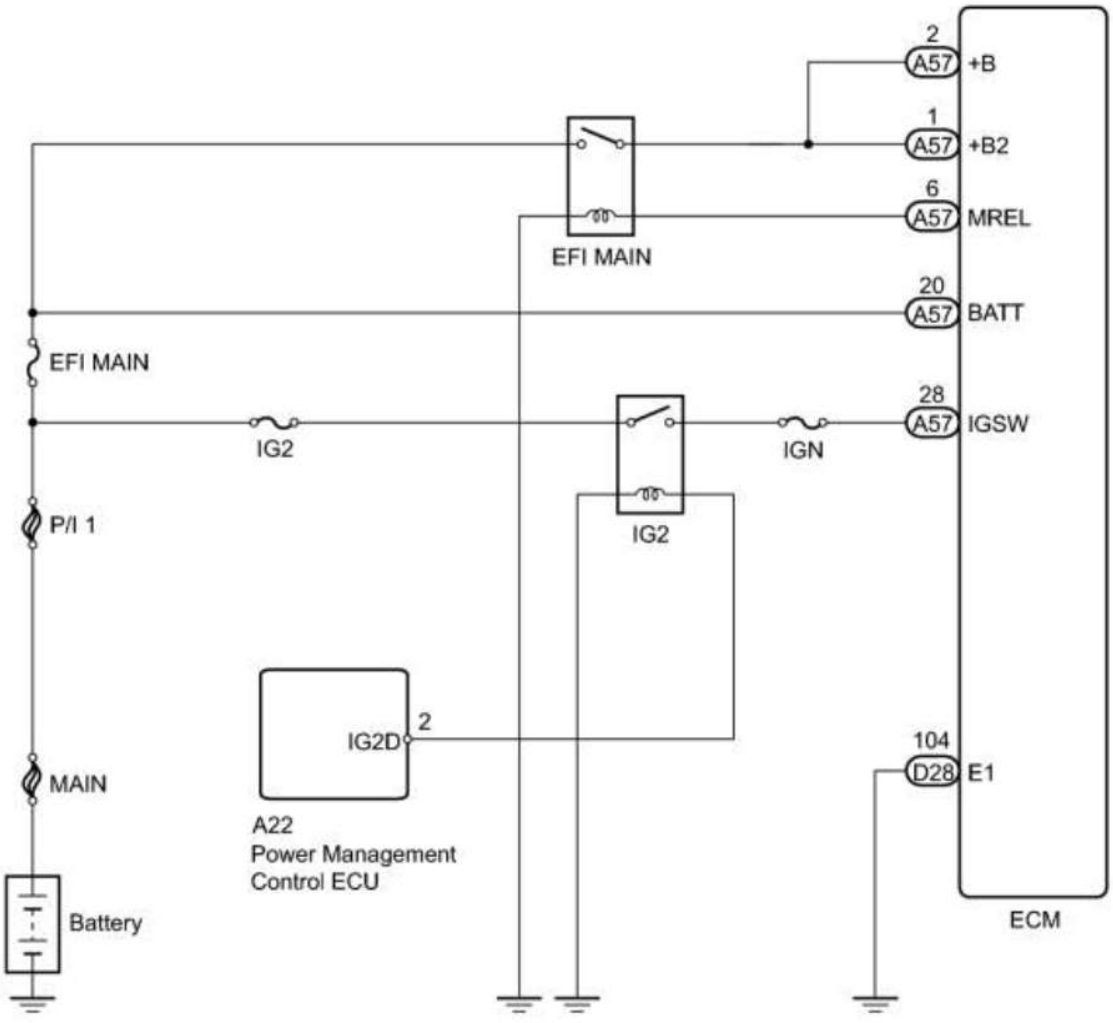
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ECM Power Source Circuit

DESCRIPTION

When the power switch is turned on (IG), battery voltage is applied to IGSW of the ECM. The output signal from the MREL terminal of the ECM causes a current to flow to the coil, closing the contacts of the integration relay (EFI MAIN relay) and supplying power to either terminal +B and +B2 of the ECM.

WIRING DIAGRAM



INSPECTION PROCEDURE

NOTICE:

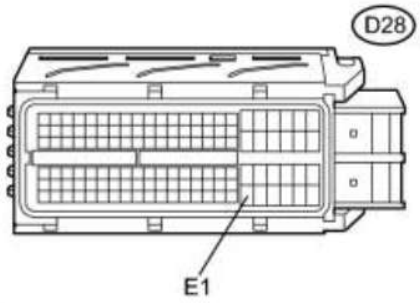
Inspect the fuses for circuits related to this system before performing the following inspection procedure.

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PROCEDURE

1.	CHECK HARNESS AND CONNECTOR (ECM - BODY GROUND)

*1



N

(a) Disconnect the ECM connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
D28-104 (E1) - Body ground	Always	Below 1 Ω

Text in Illustration

*1	Front view of wire harness connector (to ECM)

(c) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - BODY GROUND)

OK

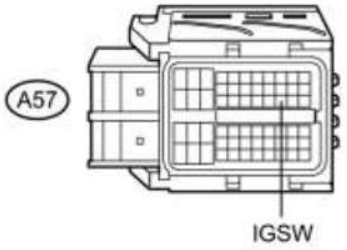
▼

2.	INSPECT ECM (IGSW VOLTAGE)

(a) Disconnect the ECM connector.

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*1



N

(b) Turn the power switch on (IG).

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
A57-28 (IGSW) - Body ground	Power switch on (IG)	11 to 14 V

Text in Illustration

*1	Front view of wire harness connector (to ECM)

(d) Reconnect the ECM connector.

NG ▶ INSPECT INTEGRATION NO.1 RELAY (IG2 RELAY)

OK

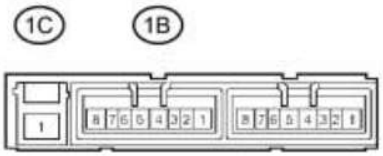
▼

3.	INSPECT INTEGRATION NO.1 RELAY (EFI MAIN RELAY)

(a) Remove the integration relay from the engine room relay block.

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*1



(b) Disconnect the integration relay connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
1C-1 - 1B-4	No battery voltage applied between terminals 1B-2 and 1B-3	10 kΩ or higher
	Battery voltage applied between terminals 1B-2 and 1B-3	Below 1 Ω

Text in Illustration

*1	Component without harness connected (Integration Relay)

(d) Reconnect the integration relay connector.

(e) Reinstall the integration relay.

NG ▶ REPLACE INTEGRATION NO.1 RELAY

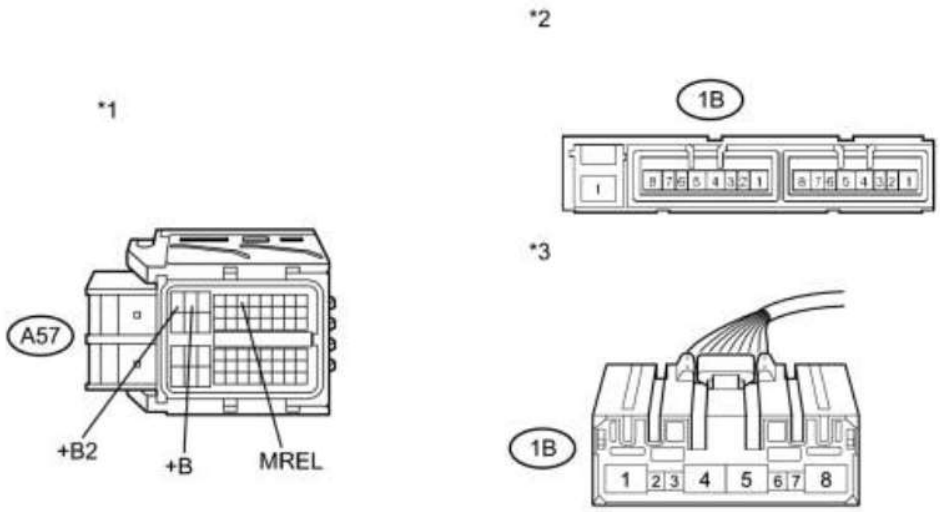
OK

▼

4.	CHECK HARNESS AND CONNECTOR (INTEGRATION RELAY (EFI MAIN RELAY) - ECM)

(a) Remove the integration relay from the engine room relay block.

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(b) Disconnect the integration relay connector.

(c) Disconnect the ECM connector.

(d) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
1B-4 - A57-1 (+B2)	Always	Below 1 Ω
1B-4 - A57-2 (+B)	Always	Below 1 Ω
1B-2 - A57-6 (MREL)	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
1B-4 or A57-1 (+B2) - Body ground	Always	10 kΩ or higher
1B-4 or A57-2 (+B) - Body ground	Always	10 kΩ or higher
1B-2 or A57-6 (MREL) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to ECM)	*2	Integration Relay
*3	Front view of wire harness connector	-	-

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	(to Integration Relay)		

(e) Reconnect the ECM connector.

(f) Reconnect the integration relay connector.

(g) Reinstall the integration relay.

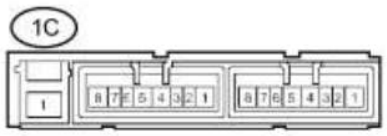
NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (INTEGRATION RELAY (EFI MAIN RELAY) - ECM)

OK

▼

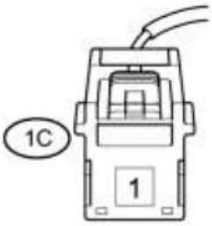
5.	CHECK HARNESS AND CONNECTOR (INTEGRATION RELAY (EFI MAIN RELAY) - BATTERY)

*1



*2

(a) Remove the integration relay from the engine room relay block.



(b) Disconnect the integration relay connector.

(c) Disconnect the negative battery terminal.

(d) Disconnect the positive battery terminal.

(e) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
1C-1 - Battery positive terminal	Always	Below 1 Ω

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Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
1C-1 or Battery positive terminal - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Integration Relay
*2	Front view of wire harness connector (to Integration Relay)

(f) Reconnect the integration relay connector.

(g) Reinstall the integration relay.

(h) Reconnect the positive battery terminal.

(i) Reconnect the negative battery terminal.

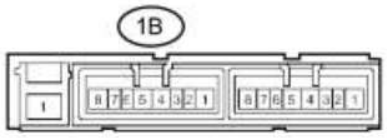
NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (INTEGRATION RELAY (EFI MAIN RELAY) - BATTERY)

OK

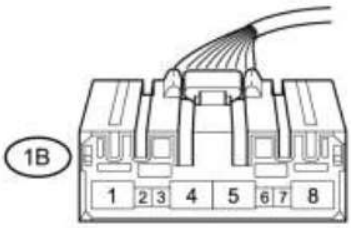
▼

6.	CHECK HARNESS AND CONNECTOR (INTEGRATION RELAY (EFI MAIN RELAY) - BODY GROUND)

*1



*2



(a) Remove the integration relay from the engine room relay block.

(b) Disconnect the integration relay connector.

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(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
1B-3 - Body ground	Always	Below 1 Ω

Text in Illustration

*1	Integration Relay
*2	Front view of wire harness connector (to Integration Relay)

(d) Reconnect the integration relay connector.

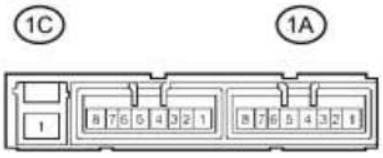
(e) Reinstall the integration relay.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (INTEGRATION RELAY (EFI MAIN RELAY) - BODY GROUND)

OK ▶ **PROCEED TO NEXT SUSPECTED AREA SHOWN IN PROBLEM SYMPTOMS TABLE**

7.	INSPECT INTEGRATION NO.1 RELAY (IG2 RELAY)

*1



(a) Remove the integration relay from the engine room relay block.

(b) Disconnect the integration relay connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
1C-1 - 1A-4	No battery voltage applied to terminals 1A-2 and 1A-3	10 kΩ or higher
	Battery voltage applied to terminals 1A-2 and 1A-3	Below 1 Ω

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Text in Illustration

*1	Component without harness connected (Integration Relay)

(d) Reconnect the integration relay connector.

(e) Reinstall the integration relay.

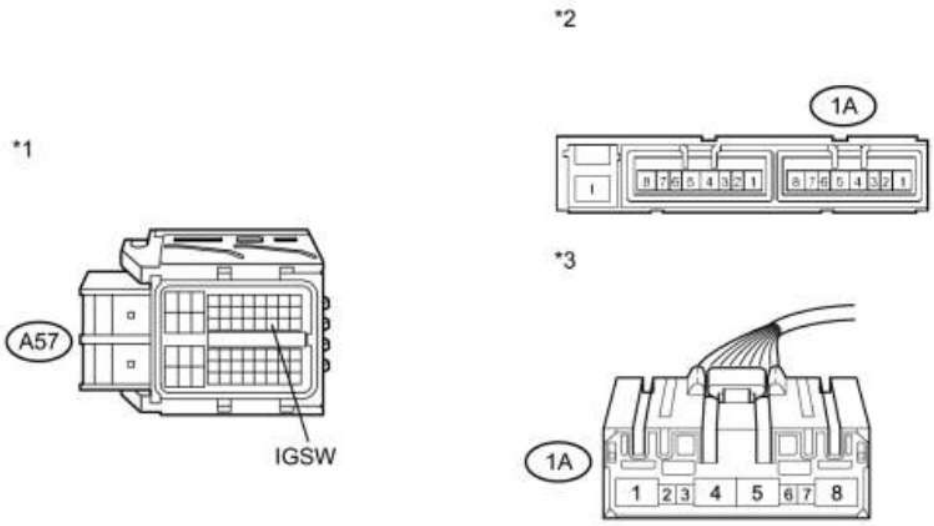
NG ▶ REPLACE INTEGRATION NO.1 RELAY (IG2 RELAY)

OK

▼

8.	CHECK HARNESS AND CONNECTOR (INTEGRATION RELAY (IG2 RELAY) - ECM)

(a) Disconnect the ECM connector.



(b) Remove the integration relay from the engine room relay block.

(c) Disconnect the integration relay connector.

(d) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition

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Tester Connection	Condition	Specified Condition
1A-4 - A57-28 (IGSW)	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
1A-4 or A57-28 (IGSW) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to ECM)	*2	Integration Relay
*3	Front view of wire harness connector (to Integration Relay)	-	-

(e) Reconnect the ECM connector.

(f) Reconnect the integration relay connector.

(g) Reinstall the integration relay.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (INTEGRATION RELAY (IG2 RELAY) - ECM)

OK

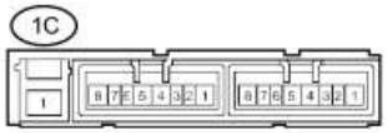
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9.	CHECK HARNESS AND CONNECTOR (INTEGRATION RELAY (IG2 RELAY) - BATTERY)

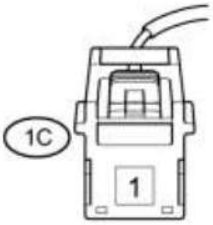
(a) Remove the integration relay from the engine room relay block.

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*1



*2



(b) Disconnect the integration relay connector.

(c) Disconnect the negative battery terminal.

(d) Disconnect the positive battery terminal.

(e) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
1C-1 - Battery positive terminal	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
1C-1 or Battery positive terminal - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Integration Relay
*2	Front view of wire harness connector (to Integration Relay)

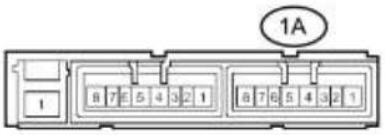
NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (INTEGRATION RELAY (IG2 RELAY) - BATTERY)

OK

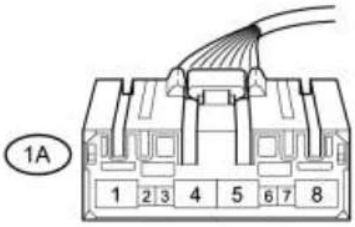
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10.	CHECK HARNESS AND CONNECTOR (INTEGRATION RELAY (IG2 RELAY) - BODY GROUND)

*1



*2



(a) Remove the integration relay from the engine room relay block.

(b) Disconnect the integration relay connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
1A-3 - Body ground	Always	Below 1 Ω

Text in Illustration

*1	Integration Relay
*2	Front view of wire harness connector (to Integration Relay)

(d) Reconnect the integration relay connector.

(e) Reinstall the integration relay.

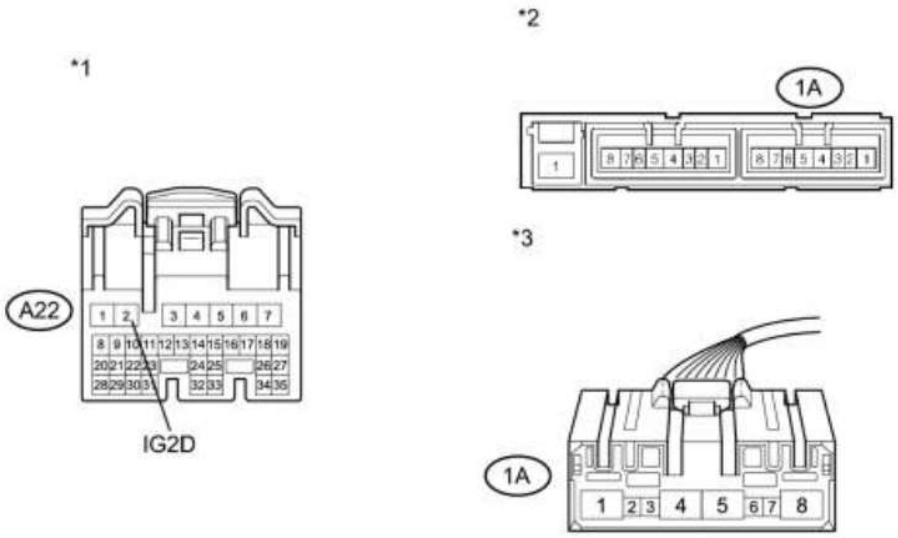
NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (INTEGRATION RELAY (IG2 RELAY) - BODY GROUND)

OK

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11.	CHECK HARNESS AND CONNECTOR (POWER MANAGEMENT CONTROL ECU - INTEGRATION RELAY (IG2 RELAY))

(a) Remove the integration relay from the engine room relay block.



(b) Disconnect the integration relay connector.

(c) Disconnect the power management control ECU connector.

(d) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
A22-2 (IG2D) - 1A-2	Always	Below 1 Ω

Text in Illustration

*1	Front view of wire harness connector (to Power Management Control ECU)	*2	Integration Relay
*3	Front view of wire harness connector (to Integration Relay)	-	-

(e) Reconnect the integration relay connector.

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(f) Reinstall the integration relay.

(g) Reconnect the power management control ECU connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (POWER MANAGEMENT CONTROL ECU - INTEGRATION RELAY (IG2 RELAY))

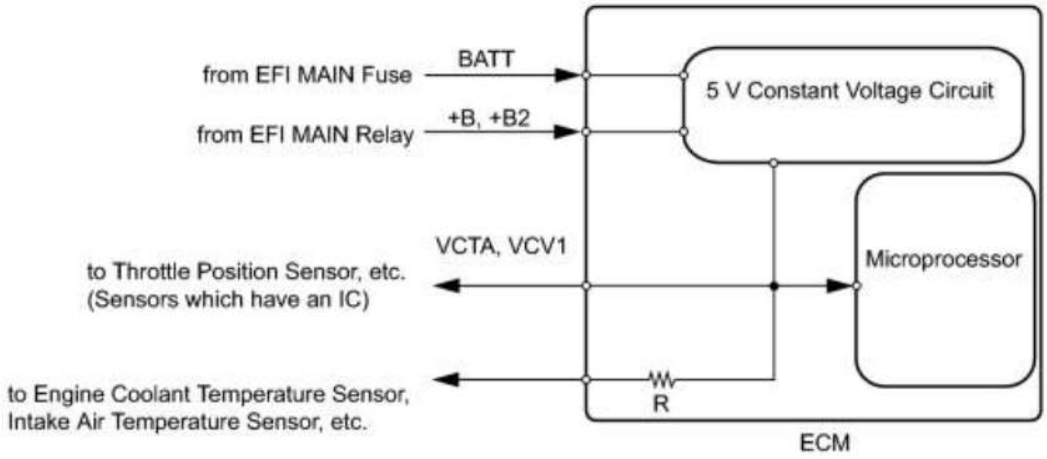
OK ▶ **CHECK SMART KEY SYSTEM**

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VC Output Circuit

DESCRIPTION

The ECM constantly uses 5 V from the battery voltages supplied to the +B (BATT) terminal to operate the microprocessor. The ECM also provides this power to the sensors through the VC output circuit.



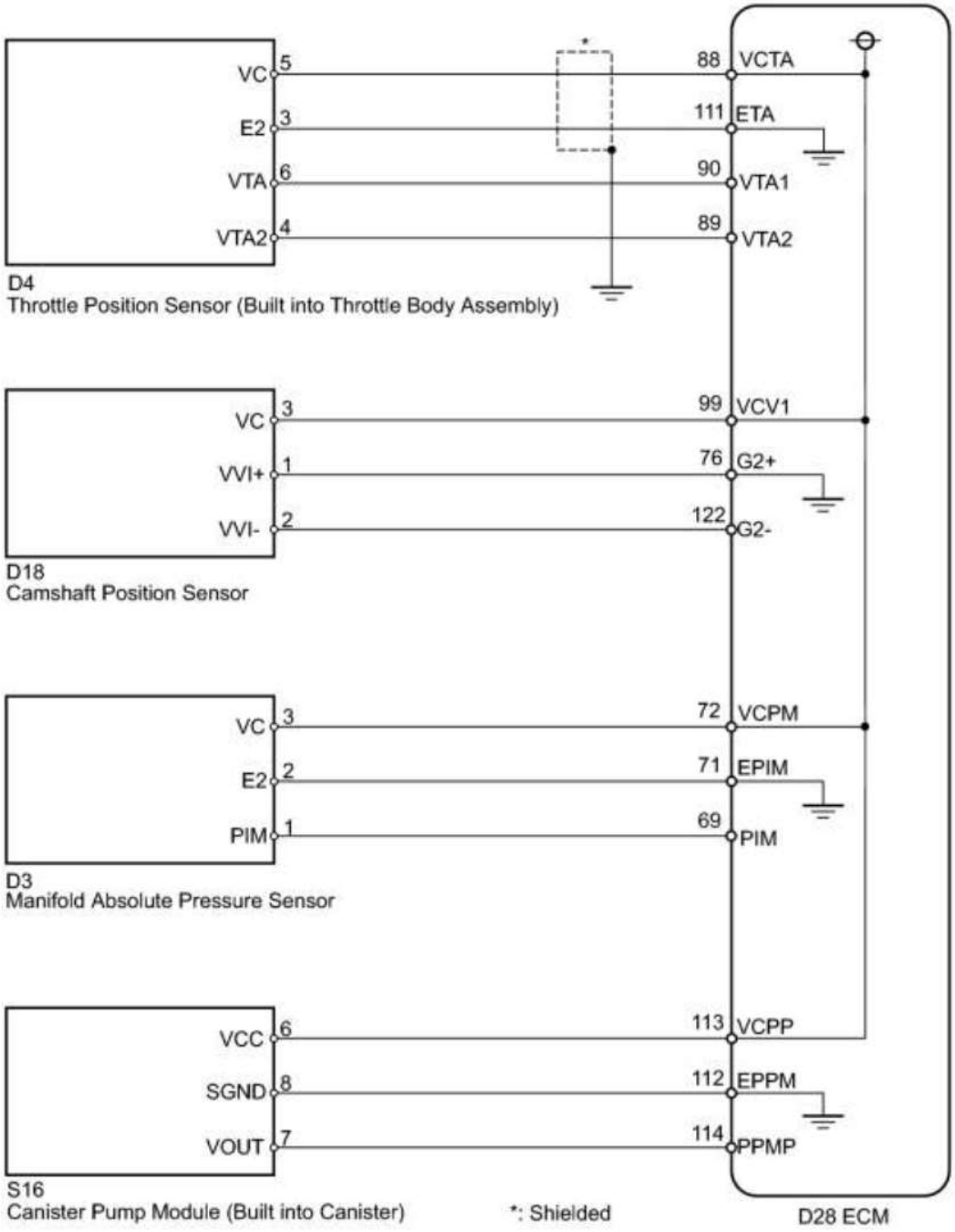
When the VC circuit is shorted, the microprocessor in the ECM and sensors that are supplied power through the VC circuit are inactivated because the power is not supplied from the VC circuit. Under this condition, the system does not start up and the MIL does not illuminate even if the system malfunctions.

HINT:

Under normal conditions, the MIL is illuminated for several seconds when the power switch is first turned on (IG). The MIL goes off when the engine is started.

WIRING DIAGRAM

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INSPECTION PROCEDURE

PROCEDURE

1.	CHECK MIL

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(a) Check that the Malfunction Indicator Lamp (MIL) illuminates when turning the power switch on (IG).

OK:

MIL lights up.

NG ▶ CHECK CONNECTION BETWEEN TECHSTREAM AND ECM

OK ▶ **PROCEED TO NEXT SUSPECTED AREA SHOWN IN PROBLEM SYMPTOMS TABLE**

2.	CHECK CONNECTION BETWEEN TECHSTREAM AND ECM

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Check the communication between the Techstream and ECM.

Result:

Result	Proceed to
Communication is possible	A
Communication is not possible	B

A ▶ GO TO MIL CIRCUIT

B ▼

3.	CHECK MIL (THROTTLE POSITION SENSOR)

(a) Disconnect the throttle position sensor connector.

(b) Turn the power switch on (IG).

(c) Check the MIL.

Result:

Result	Proceed to
MIL illuminates	A
MIL does not illuminate	B

(d) Reconnect the throttle position sensor connector.

A ▶ REPLACE THROTTLE BODY ASSEMBLY

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B

4.	CHECK MIL (CAMSHAFT POSITION SENSOR)

(a) Disconnect the camshaft position sensor connector.

(b) Turn the power switch on (IG).

(c) Check the MIL.

Result:

Result	Proceed to
MIL illuminates	A
MIL does not illuminate	B

(d) Reconnect the camshaft position sensor connector.

A REPLACE CAMSHAFT POSITION SENSOR

B

5.	CHECK MIL (MANIFOLD ABSOLUTE PRESSURE SENSOR)

(a) Disconnect the manifold absolute pressure sensor connector.

(b) Turn the power switch on (IG).

(c) Check the MIL.

Result:

Result	Proceed to
MIL illuminates	A
MIL does not illuminate	B

(d) Reconnect the manifold absolute pressure sensor connector.

A REPLACE MANIFOLD ABSOLUTE PRESSURE SENSOR

B

6.	CHECK MIL (CANISTER PUMP MODULE)

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(a) Disconnect the canister pump module connector.

(b) Turn the power switch on (IG).

(c) Check the MIL.

Result:

Result	Proceed to
MIL illuminates	A
MIL does not illuminate	B

(d) Reconnect the canister pump module connector.

A ▶ REPLACE CANISTER

B

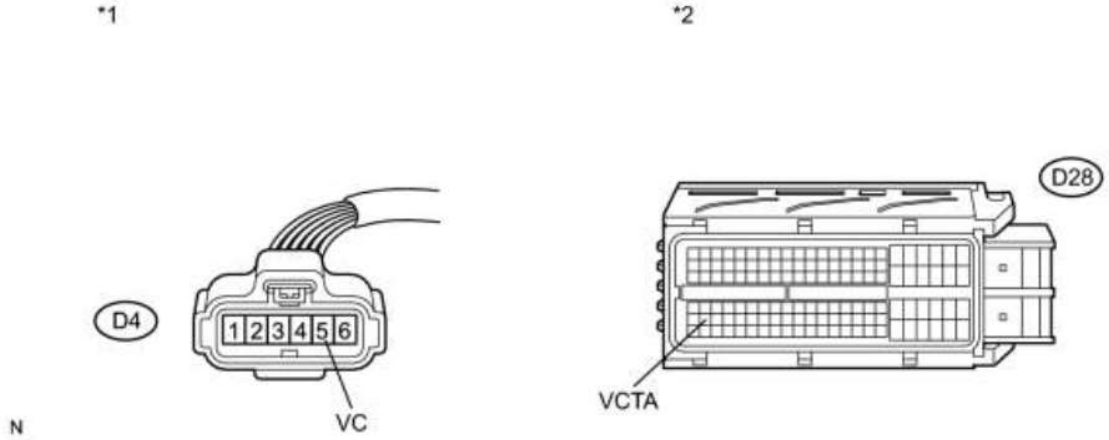
▼

7.	CHECK HARNESS AND CONNECTOR (THROTTLE POSITION SENSOR - ECM)

(a) Disconnect the throttle position sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.



Standard Resistance:

Tester Connection	Condition	Specified Condition
D28-88 (VCTA) or D4-5 (VC) - Body ground	Always	10 kΩ or higher

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Text in Illustration

*1	Front view of wire harness connector (to Throttle Position Sensor)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the throttle position sensor connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (THROTTLE POSITION SENSOR - ECM)

OK

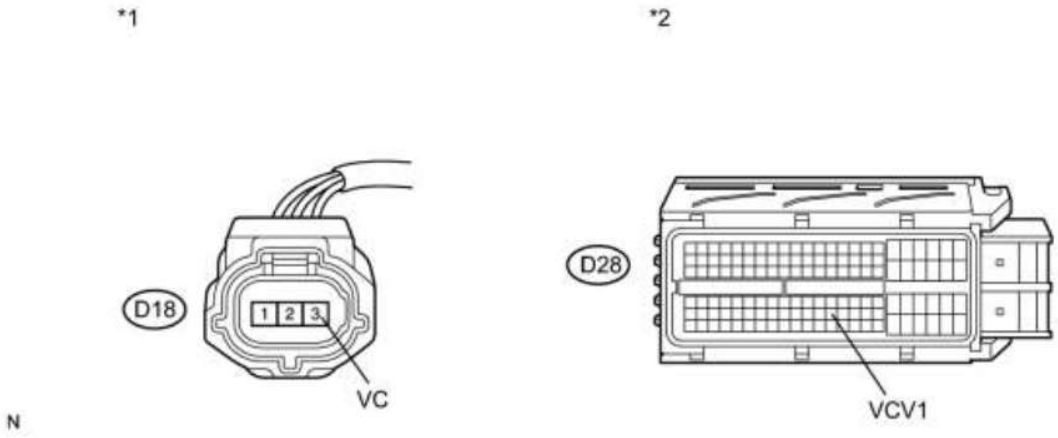
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8.	CHECK HARNESS AND CONNECTOR (CAMSHAFT POSITION SENSOR - ECM)

(a) Disconnect the camshaft position sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.



Standard Resistance:

Tester Connection	Condition	Specified Condition
D18-3 (VC) or D28-99 (VCV1) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector	*2	Front view of wire harness connector

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	(to Camshaft Position Sensor)		(to ECM)

(d) Reconnect the camshaft position sensor connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (CAMSHAFT POSITION SENSOR - ECM)

OK

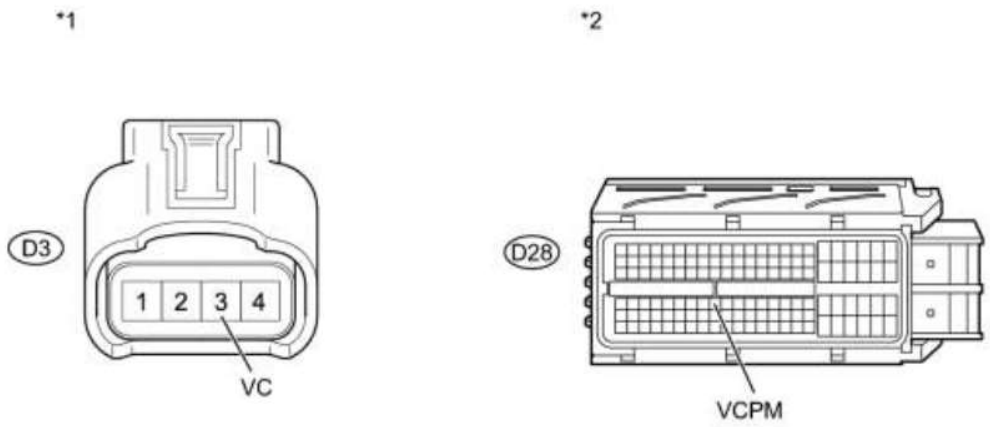
▼

9.	CHECK HARNESS AND CONNECTOR (MANIFOLD ABSOLUTE PRESSURE SENSOR - ECM)

(a) Disconnect the manifold absolute pressure sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.



Standard Resistance:

Tester Connection	Condition	Specified Condition
D3-3 (VC) or D28-72 (VCPM) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Manifold Absolute Pressure Sensor)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the manifold absolute pressure sensor connector.

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(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (MANIFOLD ABSOLUTE PRESSURE SENSOR - ECM)

OK

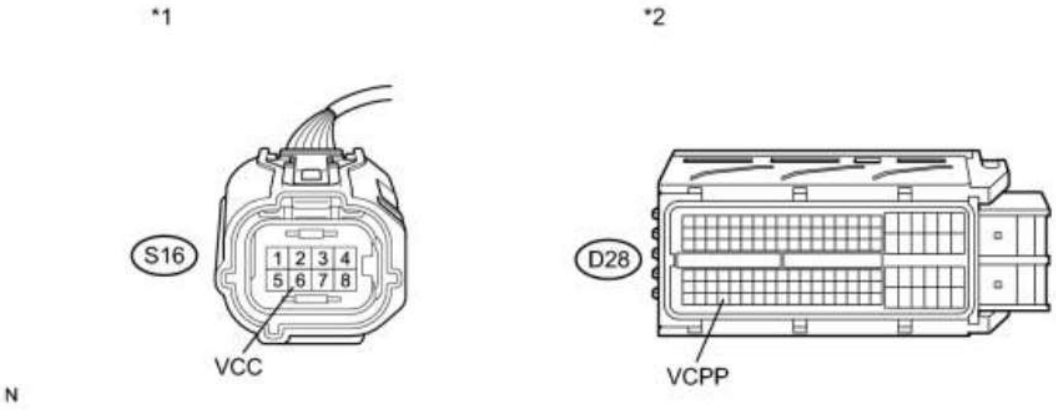
▼

10.	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)

(a) Disconnect the canister pump module connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.



Standard Resistance:

Tester Connection	Condition	Specified Condition
S16-6 (VCC) or D28-113 (VCPP) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Canister Pump Module)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the canister pump module connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (CANISTER PUMP MODULE - ECM)

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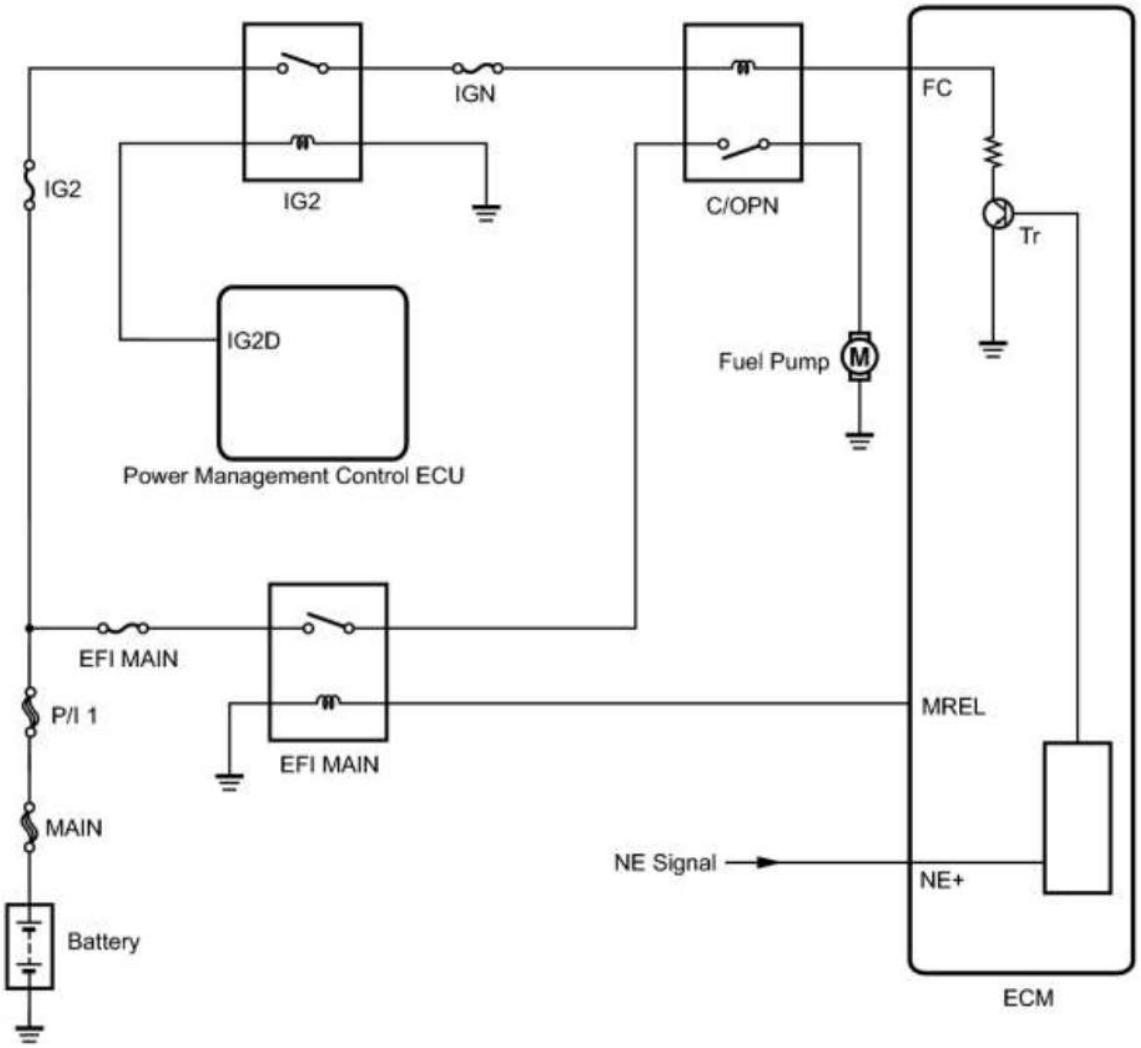
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Fuel Pump Control Circuit

DESCRIPTION

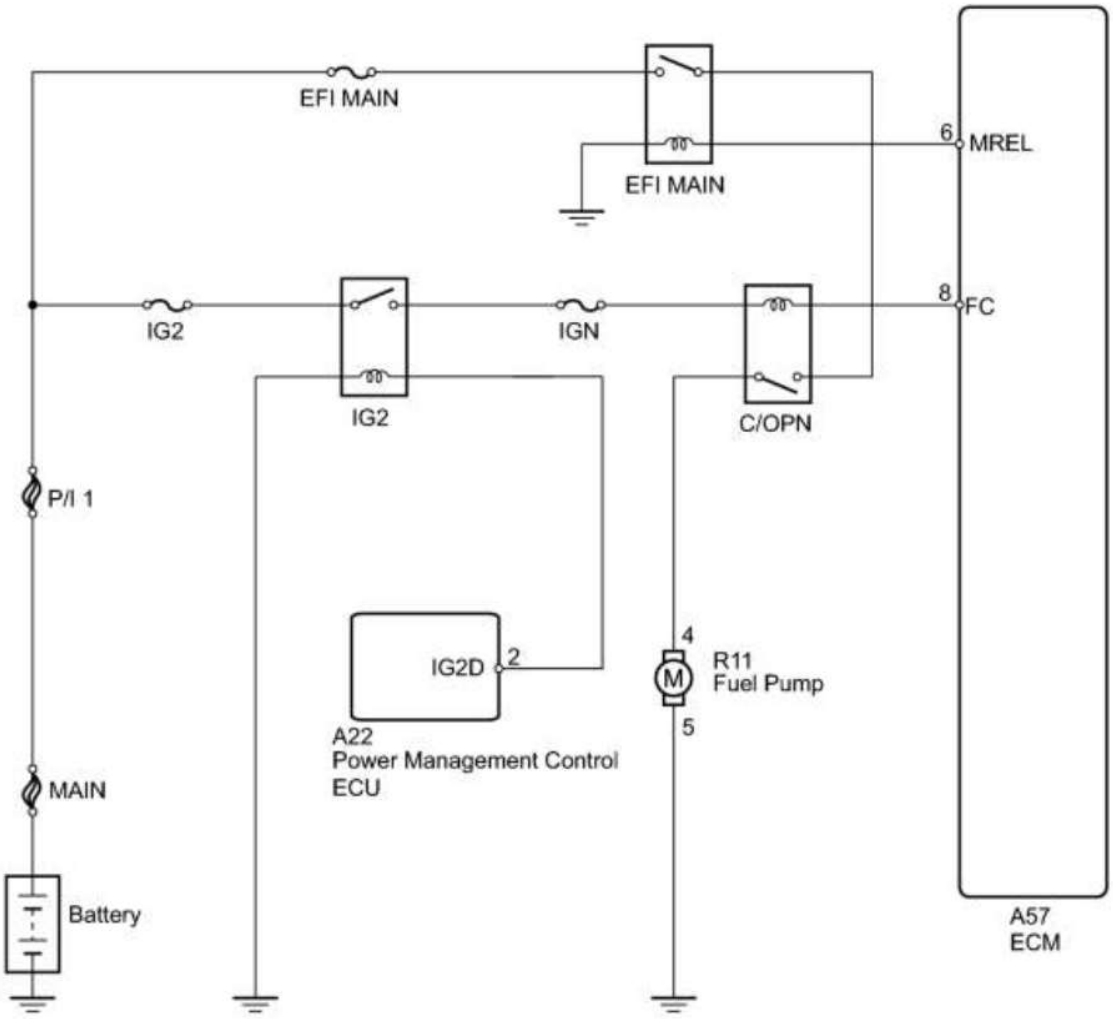
When the NE signal is input to the ECM, Tr is turned on, current flows to the coil of the circuit opening relay, the relay switches on, power is supplied to the fuel pump and the fuel pump operates.

While the NE signal is generated (engine running), the ECM keeps Tr on (circuit opening relay on) and the fuel pump also keeps operating.



WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

1.	PERFORM ACTIVE TEST USING TECHSTREAM (OPERATE C/OPN RELAY)

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the Fuel Pump / Speed.

(e) Check whether the fuel pump operation sound occurs when performing the Active Test on the Techstream.

OK:

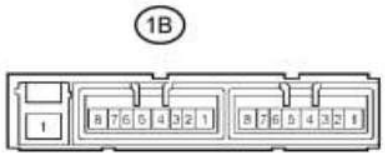
Fuel pump operating sound occurs.

NG ▶ INSPECT INTEGRATION NO.1 RELAY (C/OPN RELAY)

OK ▶ **PROCEED TO NEXT SUSPECTED AREA SHOWN IN PROBLEM SYMPTOMS TABLE**

2.	INSPECT INTEGRATION NO.1 RELAY (C/OPN RELAY)

*1



(a) Remove the integration relay from the engine room relay block.

(b) Disconnect the integration relay connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
1B-4 - 1B-8	No battery voltage applied to terminals 1B-6 and 1B-7	10 kΩ or higher
	Battery voltage applied to terminals 1B-6 and 1B-7	Below 1 Ω

Text in Illustration

*1	Component without harness connected (Integration Relay)

(d) Reconnect the integration relay connector.

(e) Reinstall the integration relay.

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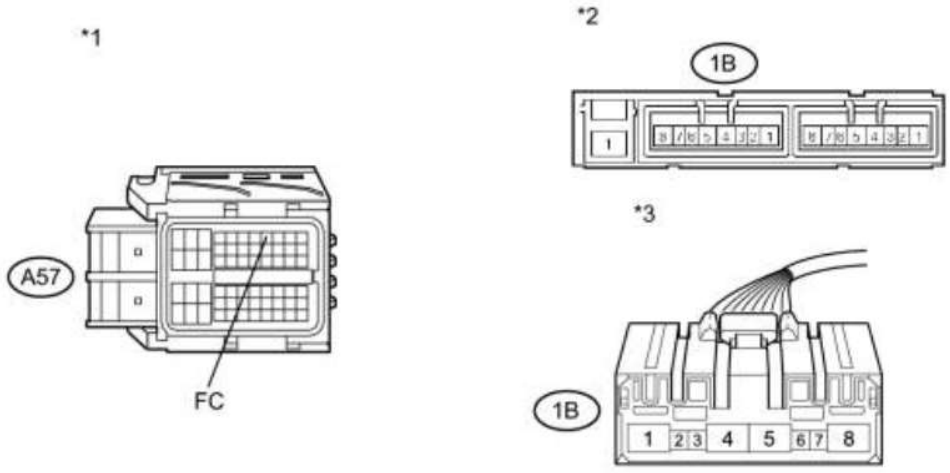
NG ▶ REPLACE INTEGRATION NO.1 RELAY (C/OPN RELAY)

OK

▼

3.	CHECK HARNESS AND CONNECTOR (C/OPN RELAY - ECM)

(a) Disconnect the ECM connector.



(b) Remove the integration relay from the engine room relay block.

(c) Disconnect the integration relay connector.

(d) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
1B-7 - A57-8 (FC)	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
1B-7 or A57-8 (FC) - Body ground	Always	10 kΩ or higher

Text in Illustration

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*1	Front view of wire harness connector (to ECM)	*2	Integration Relay
*3	Front view of wire harness connector (to Integration Relay)	-	-

(e) Reconnect the ECM connector.

(f) Reconnect the integration relay connector.

(g) Reinstall the integration relay.

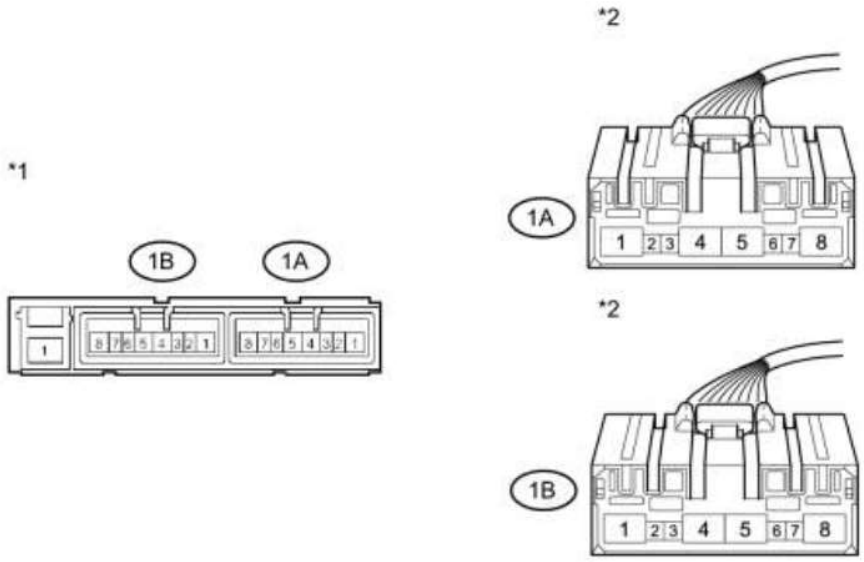
NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (C/OPN RELAY - ECM)

OK

▼

4.	CHECK HARNESS AND CONNECTOR (C/OPN RELAY - IG2 RELAY)

(a) Remove the integration relay from the engine room relay block.



(b) Disconnect the integration relay connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

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Tester Connection	Condition	Specified Condition
1A-4 - 1B-6	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
1A-4 or 1B-6 - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Integration Relay	*2	Front view of wire harness connector (to Integration Relay)

(d) Reconnect the integration relay connector.

(e) Reinstall the integration relay.

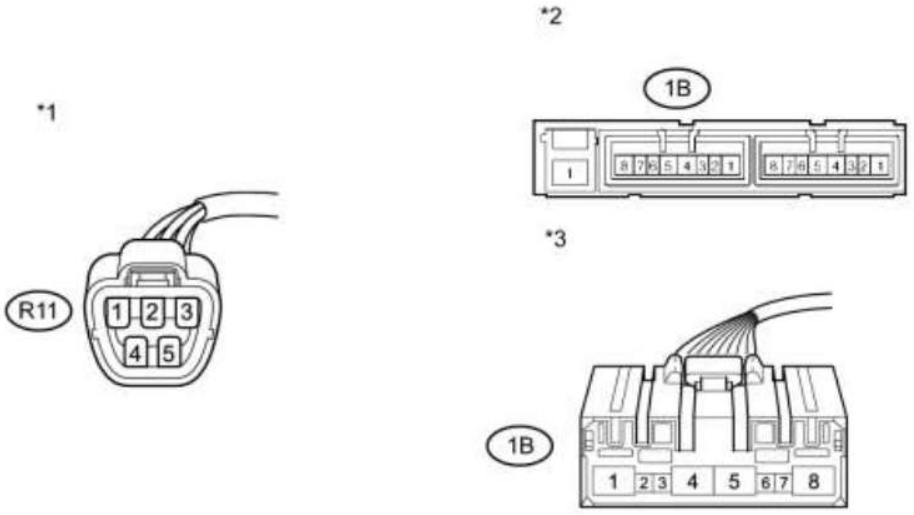
NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (C/OPN RELAY - IG2 RELAY)

OK

▼

5.	CHECK HARNESS AND CONNECTOR (C/OPN RELAY - FUEL PUMP)

(a) Disconnect the fuel pump connector.



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(b) Remove the integration relay from the engine room relay block.

(c) Disconnect the integration relay connector.

(d) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
1B-8 - R11-4	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
1B-8 or R11-4 - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Fuel Pump)	*2	Integration Relay
*3	Front view of wire harness connector (to Integration Relay)	-	-

(e) Reconnect the fuel pump connector.

(f) Reconnect the integration relay connector.

(g) Reinstall the integration relay.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (C/OPN RELAY - FUEL PUMP)

OK

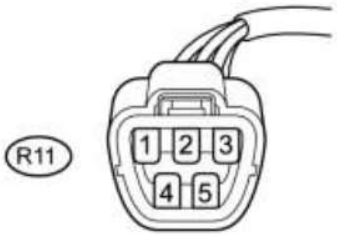
▼

6.	CHECK HARNESS AND CONNECTOR (FUEL PUMP - BODY GROUND)

(a) Disconnect the fuel pump connector.

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*1



N

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
R11-5 - Body ground	Always	Below 1 Ω

Text in Illustration

*1	Front view of wire harness connector (to Fuel Pump)

(c) Reconnect the fuel pump connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (FUEL PUMP - BODY GROUND)

OK

▼

7.	INSPECT FUEL PUMP

(a) Inspect the fuel pump INFO.

NG ▶ REPLACE FUEL PUMP

OK

▼

8.	CHECK ECM POWER SOURCE CIRCUIT

(a) Check the ECM power source circuit INFO.

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NG ▶ REPAIR OR REPLACE ECM POWER SOURCE CIRCUIT

OK ▶ **REPLACE ECM**

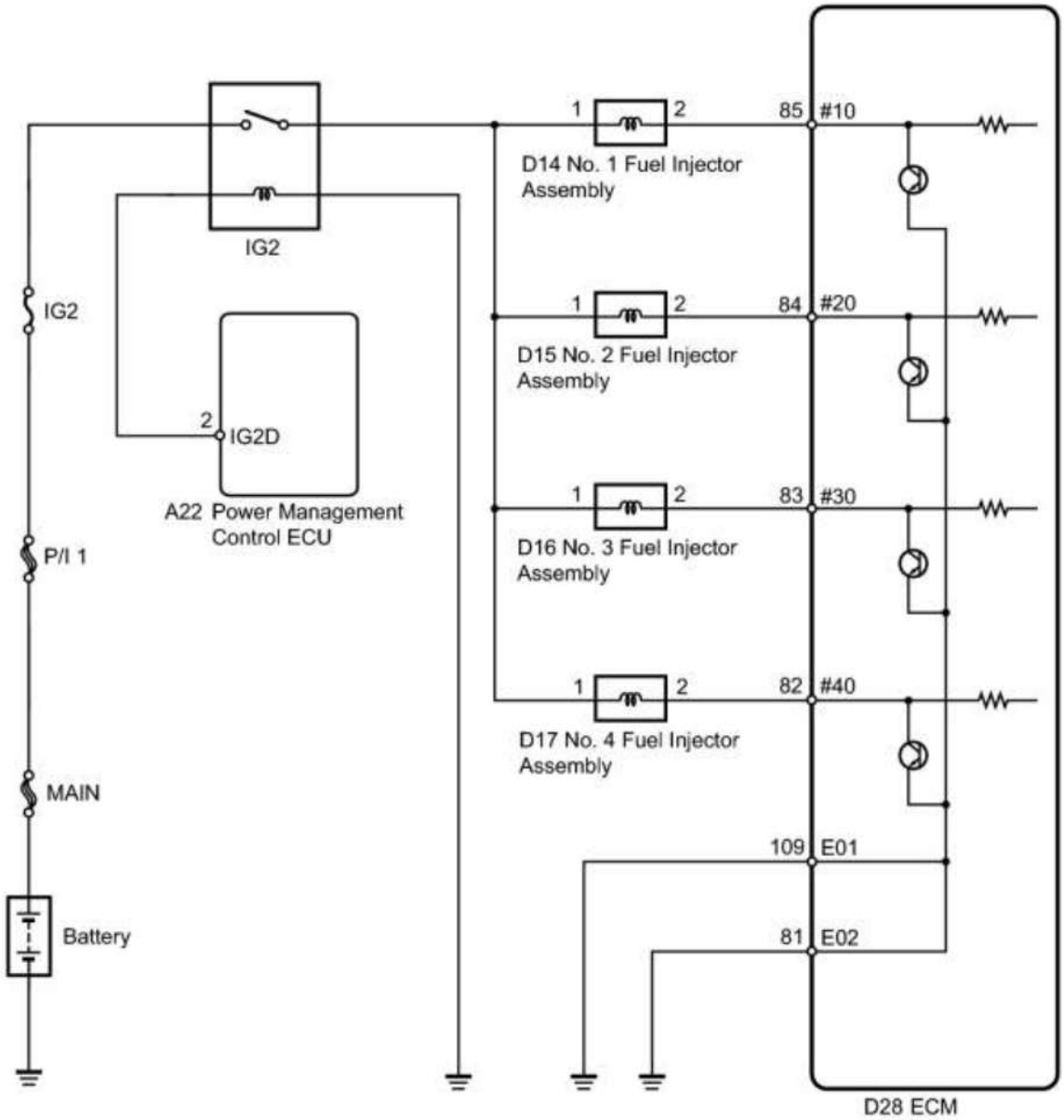
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Fuel Injector Circuit

DESCRIPTION

The fuel injectors are located on the intake manifold. They inject fuel into the cylinders based on the signals from the ECM.

WIRING DIAGRAM



INSPECTION PROCEDURE

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PROCEDURE

1.	CHECK FUEL INJECTOR ASSEMBLY (POWER SOURCE)

*1



(a) Disconnect the fuel injector assembly connectors.

N

(b) Turn the power switch on (IG).

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
D14-1 - Body ground	Power switch on (IG)	11 to 14 V
D15-1 - Body ground	Power switch on (IG)	11 to 14 V
D16-1 - Body ground	Power switch on (IG)	11 to 14 V
D17-1 - Body ground	Power switch on (IG)	11 to 14 V

Text in Illustration

*1	Front view of wire harness connector (to Fuel Injector Assembly)

(d) Reconnect the fuel injector assembly connectors.

NG ▶ CHECK HARNESS AND CONNECTOR (INTEGRATION RELAY (IG2 RELAY) - FUEL INJECTOR ASSEMBLY)

OK

▼

2.	INSPECT FUEL INJECTOR ASSEMBLY

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(a) Inspect the fuel injector assembly INFO.

NG ▶ REPLACE FUEL INJECTOR ASSEMBLY

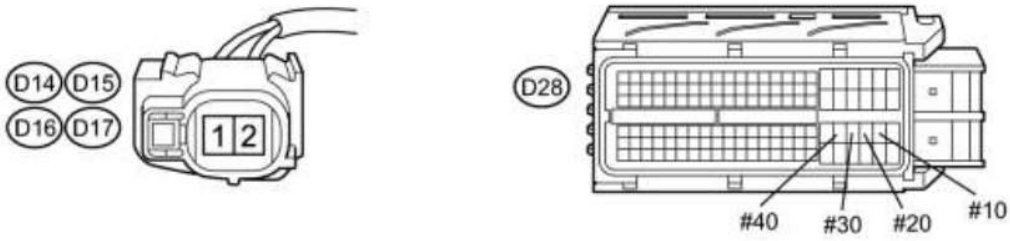
OK

▼

3.	CHECK HARNESS AND CONNECTOR (FUEL INJECTOR ASSEMBLY - ECM)

(a) Disconnect the fuel injector assembly connectors.

*1 *2



N

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D14-2 - D28-85 (#10)	Always	Below 1 Ω
D15-2 - D28-84 (#20)	Always	Below 1 Ω
D16-2 - D28-83 (#30)	Always	Below 1 Ω
D17-2 - D28-82 (#40)	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D14-2 or D28-85 (#10) - Body ground	Always	10 Ω or higher
D15-2 or D28-84 (#20) - Body ground	Always	10 Ω or higher
D16-2 or D28-83 (#30) - Body ground	Always	10 Ω or higher
D17-2 or D28-82 (#40) - Body ground	Always	10 Ω or higher

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Text in Illustration

*1	Front view of wire harness connector (to Fuel Injector Assembly)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the fuel injector assembly connectors.

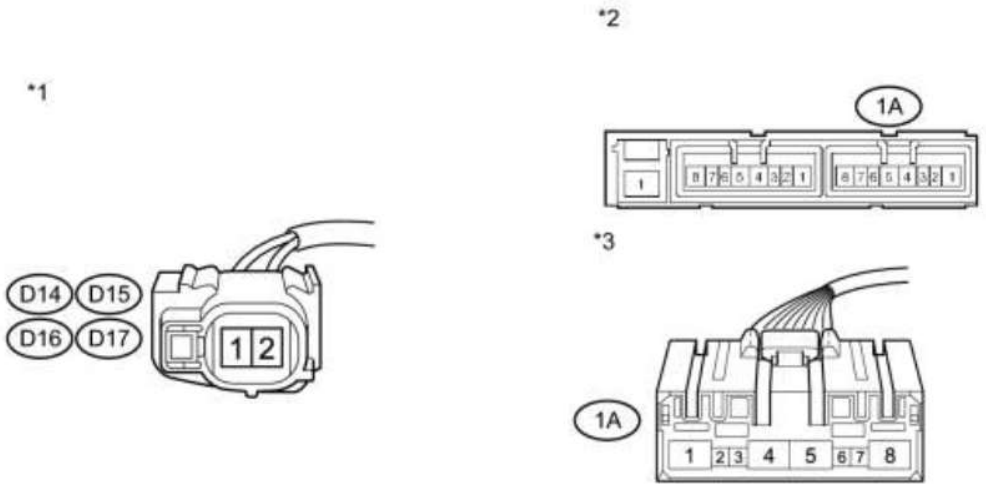
(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (FUEL INJECTOR ASSEMBLY - ECM)

OK ▶ **PROCEED TO NEXT SUSPECTED AREA SHOWN IN PROBLEM SYMPTOMS TABLE**

4.	CHECK HARNESS AND CONNECTOR (INTEGRATION RELAY (IG2 RELAY) - FUEL INJECTOR ASSEMBLY)

(a) Disconnect the fuel injector assembly connectors.



(b) Remove the integration relay from the engine room relay block.

(c) Disconnect the integration relay connector.

(d) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
D14-1 - 1A-4	Always	Below 1 Ω

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Tester Connection	Condition	Specified Condition
D15-1 - 1A-4	Always	Below 1 Ω
D16-1 - 1A-4	Always	Below 1 Ω
D17-1 - 1A-4	Always	Below 1 Ω

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D14-1 or 1A-4 - Body ground	Always	10 kΩ or higher
D15-1 or 1A-4 - Body ground	Always	10 kΩ or higher
D16-1 or 1A-4 - Body ground	Always	10 kΩ or higher
D17-1 or 1A-4 - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to Fuel Injector Assembly)	*2	Integration Relay
*3	Front view of wire harness connector (to Integration Relay)	-	-

(e) Reconnect the fuel injector assembly connectors.

(f) Reconnect the integration relay connector.

(g) Reinstall the integration relay.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (INTEGRATION RELAY (IG2 RELAY) - FUEL INJECTOR ASSEMBLY)

OK ▶ **CHECK ECM POWER SOURCE CIRCUIT**

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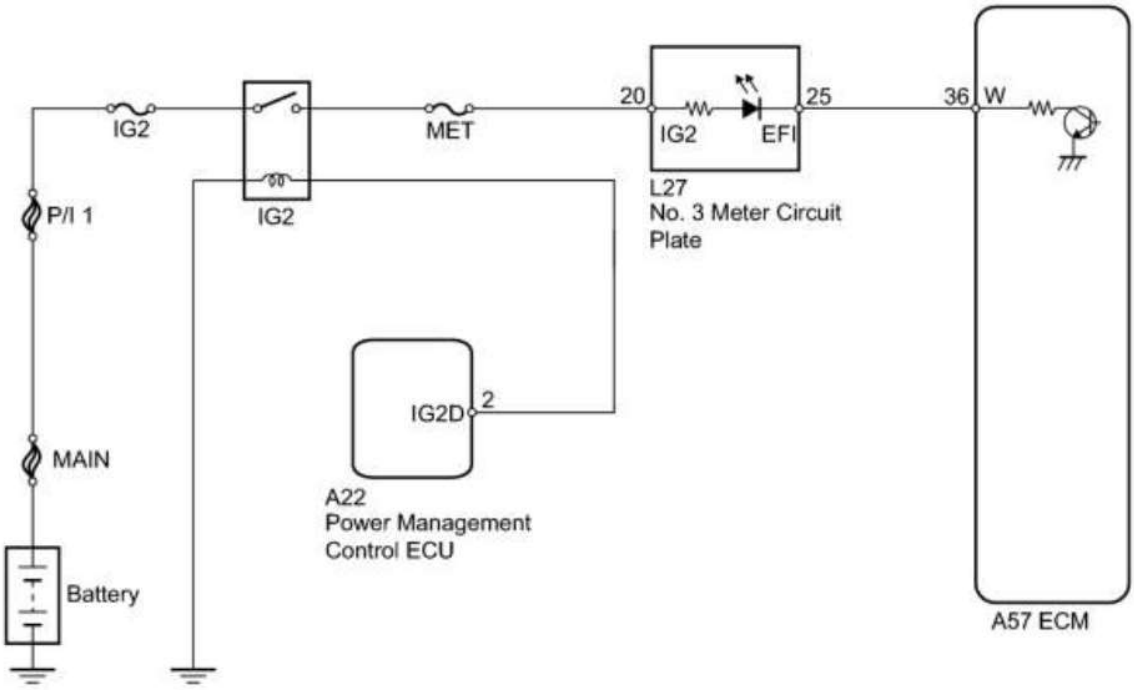
MIL Circuit

DESCRIPTION

The MIL (Malfunction Indicator Lamp) is used to indicate vehicle malfunction detected by the ECM. When the power switch is turned on (IG), power is supplied to the MIL circuit, and the ECM provides the circuit ground which illuminates the MIL.

The MIL operation can be checked visually: When the power switch is first turned on (IG), the MIL should illuminate and should then turn off. If the MIL remains illuminated or is not illuminated, conduct the following troubleshooting procedure using the Techstream.

WIRING DIAGRAM



INSPECTION PROCEDURE

PROCEDURE

1.	CHECK THAT MIL IS ILLUMINATED

(a) Turn the power switch on (IG).

(b) Check the illumination of the MIL.

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Result:

Condition	Proceed to
MIL remains illuminated (Even after power switch is turned on (IG) and several seconds have passed, MIL still remains illuminated)	A
MIL remains off (Does not illuminate at all)	B
MIL illuminates for several seconds, but turns off after engine is started	C

C ▶ SYSTEM OK

B ▶ CHECK THAT ENGINE STARTS

A

▼

2.	CHECK WHETHER MIL TURNS OFF

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.

(e) Check if any DTCs have been stored. Note down the DTCs.

(f) Clear the DTCs INFO.

(g) Check if the MIL goes off.

OK:

MIL goes off.

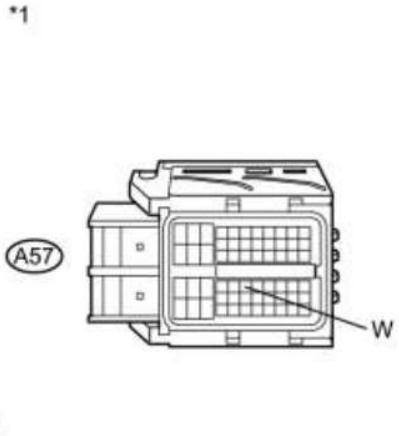
NG ▶ CHECK HARNESS AND CONNECTOR (CHECK FOR SHORT IN WIRE HARNESS)

OK ▶ **REPAIR CIRCUITS INDICATED BY OUTPUT DTCS**

3.	CHECK HARNESS AND CONNECTOR (CHECK FOR SHORT IN WIRE HARNESS)

(a) Disconnect the ECM connector.

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Text in Illustration

*1	Front view of wire harness connector (to ECM)

(b) Turn the power switch on (IG).

(c) Check that the MIL is not illuminated.

OK:

MIL is not illuminated.

(d) Reconnect the ECM connector.

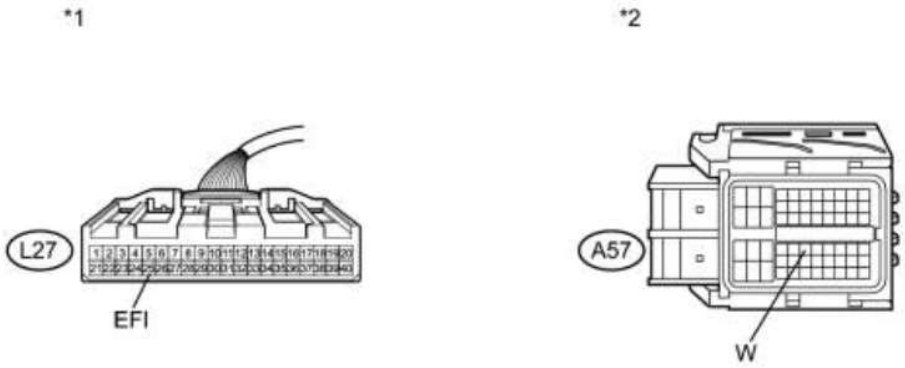
NG ▶ CHECK HARNESS AND CONNECTOR (NO. 3 METER CIRCUIT PLATE - ECM)

OK ▶ **REPLACE ECM**

4.	CHECK HARNESS AND CONNECTOR (NO. 3 METER CIRCUIT PLATE - ECM)

(a) Disconnect the No. 3 meter circuit plate connector.

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(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
L27-25 (EFI) or A57-36 (W) - Body ground	Always	10 kΩ or higher

Text in Illustration

*1	Front view of wire harness connector (to No. 3 Meter Circuit Plate)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the No. 3 meter circuit plate connector.

(e) Reconnect the ECM connector.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (NO. 3 METER CIRCUIT PLATE - ECM)

OK ▶ **REPLACE NO. 3 METER CIRCUIT PLATE**

5.	CHECK THAT ENGINE STARTS

(a) Turn the power switch on (IG).

(b) Put the engine in inspection mode INFO.

(c) Start the engine.

Result:

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Result	Proceed to
Engine starts	A
Engine cannot be put in inspection mode* (Engine cannot start)	B

HINT:

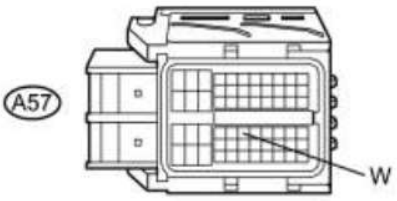
*: The Techstream cannot communicate with the ECM.

B GO TO VC OUTPUT CIRCUIT

A

6.	CHECK HARNESS AND CONNECTOR (ECM TERMINAL VOLTAGE)

*1



(a) Disconnect the ECM connector.

N

(b) Turn the power switch on (IG).

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
A57-36 (W) - Body ground	Power switch on (IG)	11 to 14 V

Text in Illustration

*1	Front view of wire harness connector (to ECM)

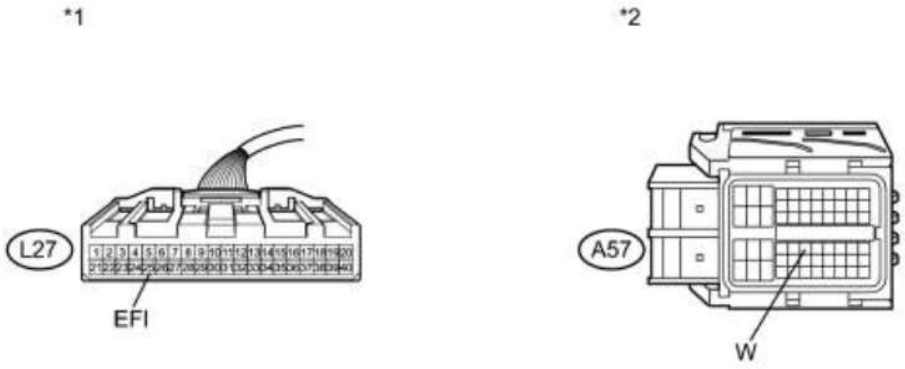
NG CHECK HARNESS AND CONNECTOR (NO. 3 METER CIRCUIT PLATE - ECM)

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OK ▶ **REPLACE ECM**

7.	CHECK HARNESS AND CONNECTOR (NO. 3 METER CIRCUIT PLATE - ECM)

(a) Disconnect the No. 3 meter circuit plate connector.



(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

Tester Connection	Condition	Specified Condition
L27-25 (EFI) - A57-36 (W)	Always	Below 1 Ω

Text in Illustration

*1	Front view of wire harness connector (to No. 3 Meter Circuit Plate)	*2	Front view of wire harness connector (to ECM)

(d) Reconnect the ECM connector.

(e) Reconnect the No. 3 meter circuit plate connector.

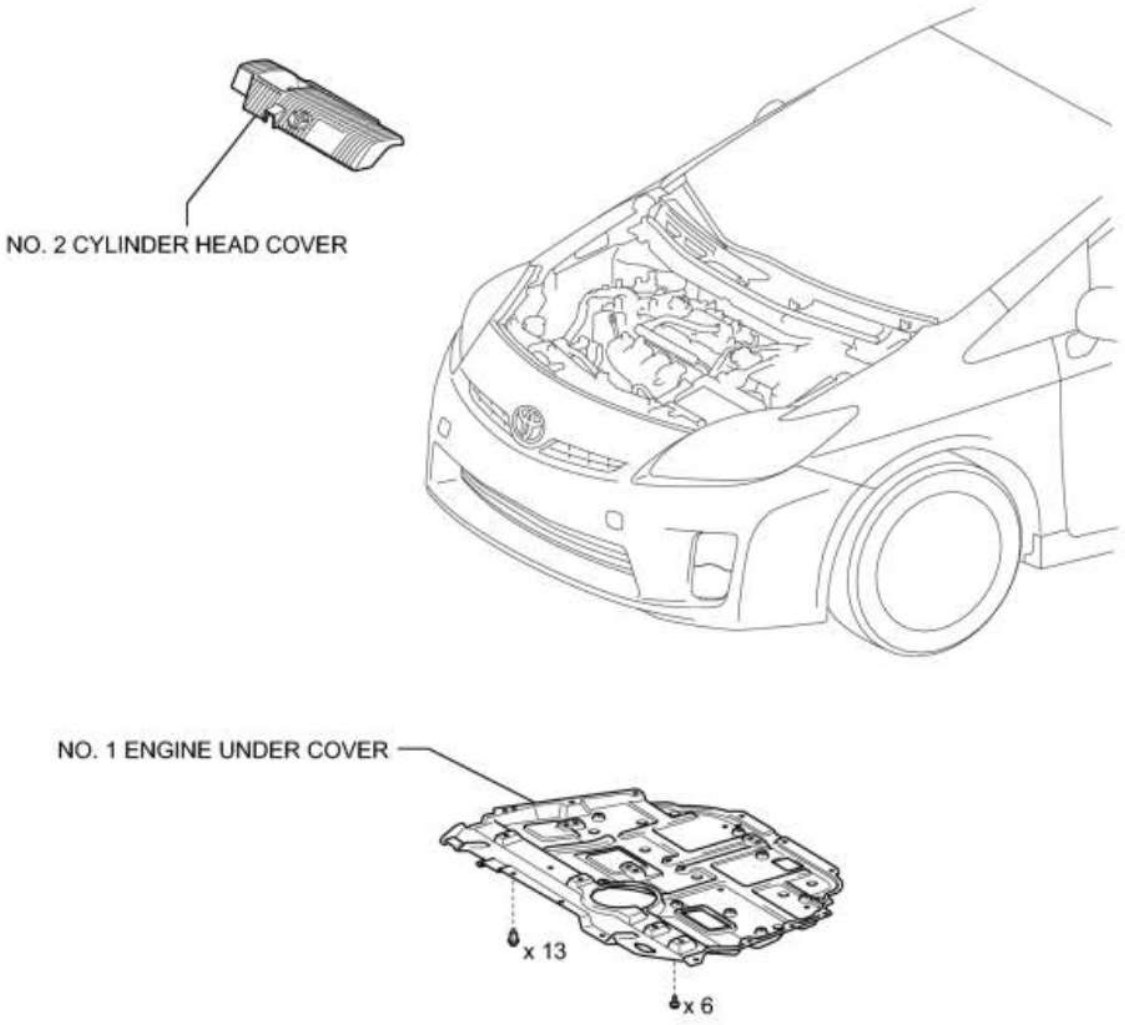
NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (NO. 3 METER CIRCUIT PLATE - ECM)

OK ▶ **REPLACE NO. 3 METER CIRCUIT PLATE**

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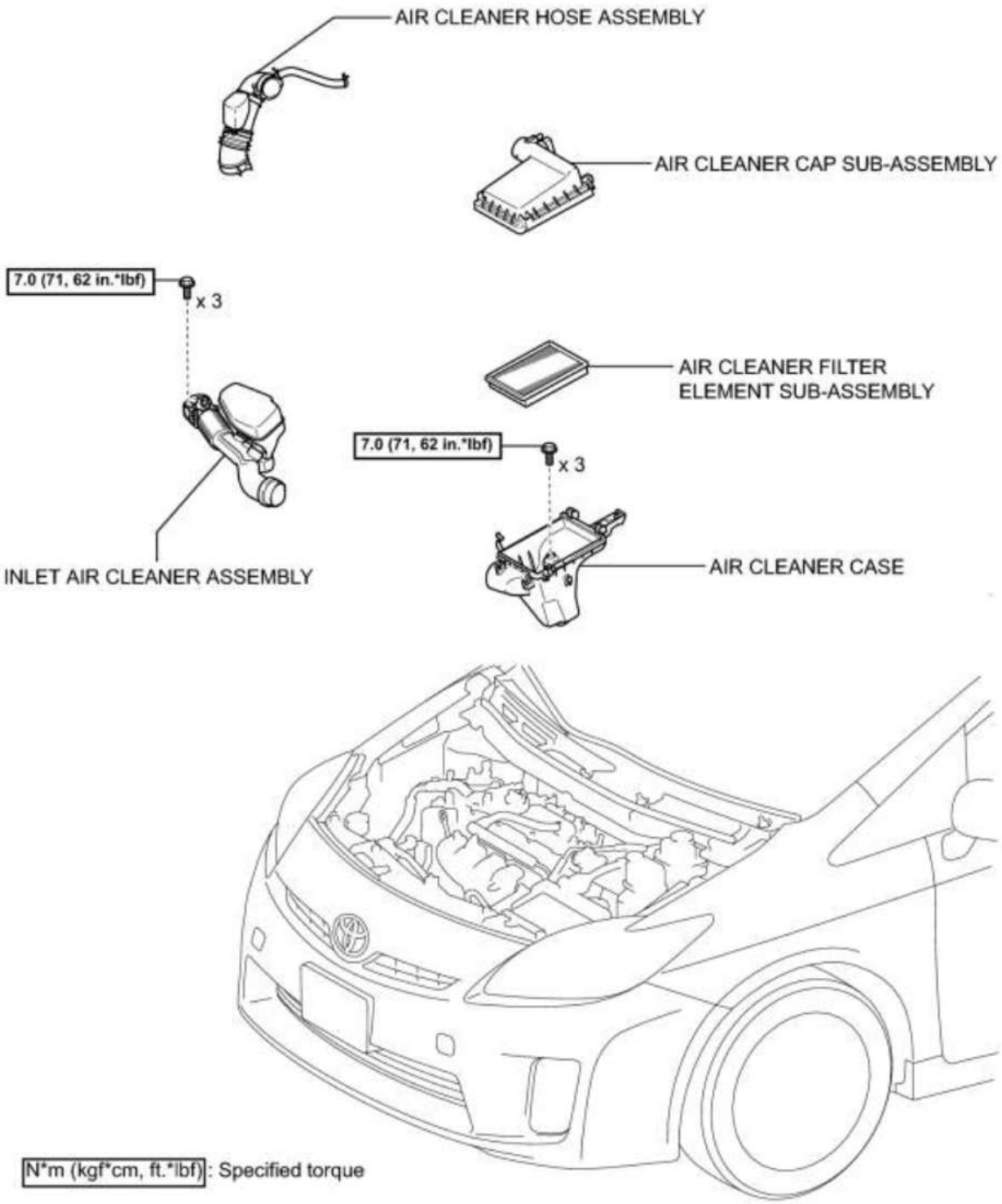
COMPONENTS

ILLUSTRATION



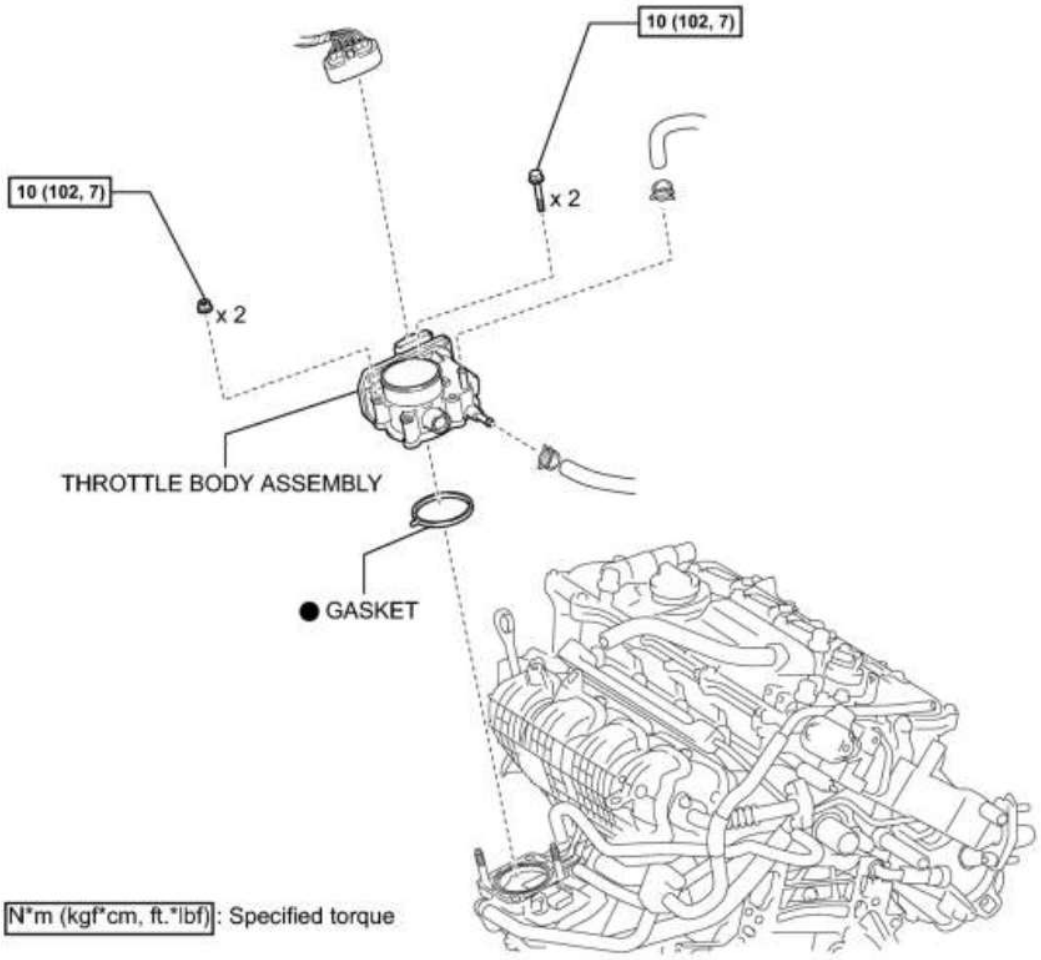
ILLUSTRATION

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ILLUSTRATION

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ON-VEHICLE INSPECTION

1. INSPECT THROTTLE BODY ASSEMBLY

(a) Check for throttle control motor operating sound.

(1) Turn the power switch on (IG).

(2) When depressing the accelerator pedal, check the operating sound of the motor. Make sure that no friction noises are emitted from the motor. If any friction noise exists, replace the throttle body assembly.

(b) Set the vehicle to the inspection mode INFO.

(c) Start the engine and check that the MIL is not illuminated. After the engine is warmed up, check that the idle speed is within the specified range when the A/C is switched off.

Standard:

Condition	Engine Idle Speed
A/C switched off	950 to 1050 rpm

NOTICE:

- Be sure to perform this step with all accessories off.
- Make sure that park (P) is selected.

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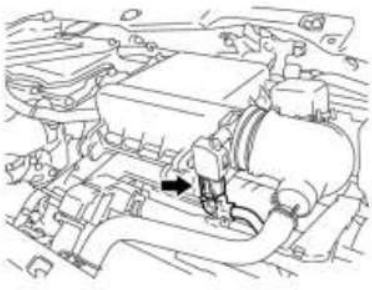
REMOVAL

1. REMOVE NO. 1 ENGINE UNDER COVER

2. DRAIN ENGINE COOLANT (for Engine) INFO

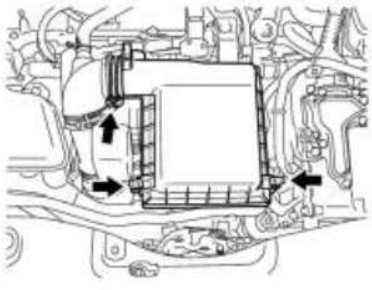
3. REMOVE NO. 2 CYLINDER HEAD COVER INFO

4. REMOVE AIR CLEANER CAP SUB-ASSEMBLY



C

(a) Disconnect the mass air flow meter connector.



C

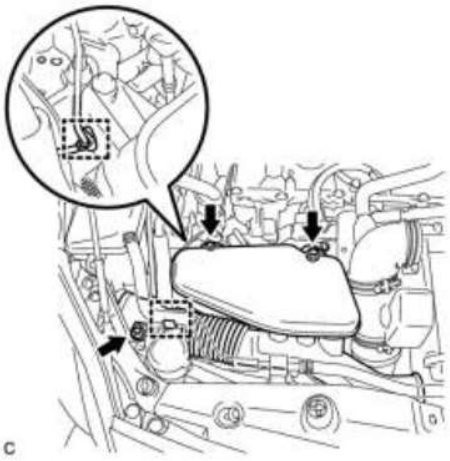
(b) Release the 2 clamps.

(c) Loosen the hose clamp and remove the air cleaner cap.

5. REMOVE INLET AIR CLEANER ASSEMBLY

(a) Separate the hose from the hose clamp.

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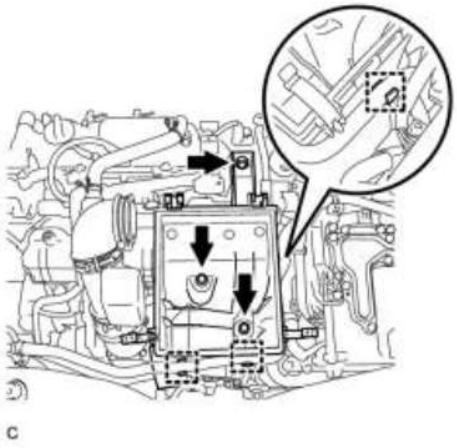


(b) Separate the wire harness clamp from the inlet air cleaner assembly.

(c) Remove the 3 bolts and inlet air cleaner assembly.

6. REMOVE AIR CLEANER CASE

(a) Remove the air cleaner filter element.



(b) Separate the hose from the 3 hose clamps.

(c) Remove the 3 bolts and air cleaner case.

7. REMOVE AIR CLEANER HOSE ASSEMBLY

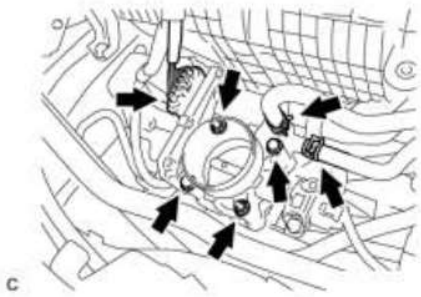
(a) Loosen the hose clamp and separate the ventilation hose.

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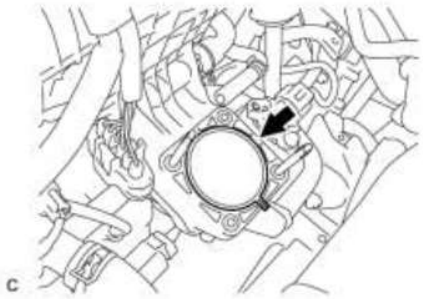
(b) Unlock the hose clamp and remove the air cleaner hose assembly.

8. REMOVE THROTTLE BODY ASSEMBLY



(a) Disconnect the throttle body connector and the 2 water by-pass hoses.

(b) Remove the 2 bolts, 2 nuts and throttle body assembly.



(c) Remove the gasket from the intake manifold.

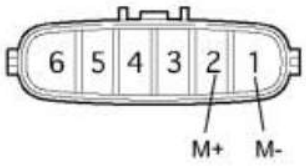
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INSPECTION

1. INSPECT THROTTLE BODY ASSEMBLY

(a) Measure the resistance according to the value(s) in the table below.

*1



Text in Illustration

*1	Component without harness connected (Throttle Body)

Standard Resistance:

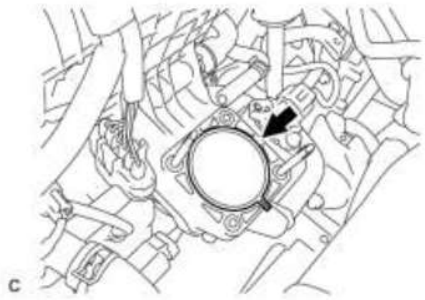
Tester Connection	Condition	Specified Condition
1 (M-) - 2 (M+)	20°C (68°F)	0.3 to 100 Ω

If the result is not as specified, replace the throttle body assembly.

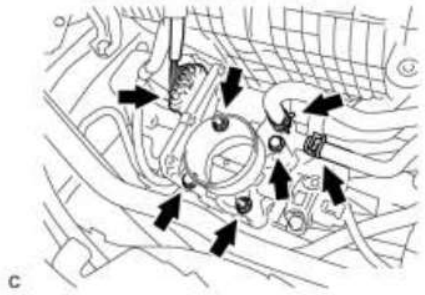
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INSTALLATION

1. INSTALL THROTTLE BODY ASSEMBLY



(a) Install a new gasket onto the intake manifold.



(b) Install the throttle body assembly with the 2 bolts and 2 nuts.

Torque: **10 N·m (102 kgf·cm, 7ft·lbf)**

(c) Connect the 2 water by-pass hoses and throttle body connector.

2. INSTALL AIR CLEANER HOSE ASSEMBLY



(a) Install the air cleaner hose assembly and lock the hose clamp.

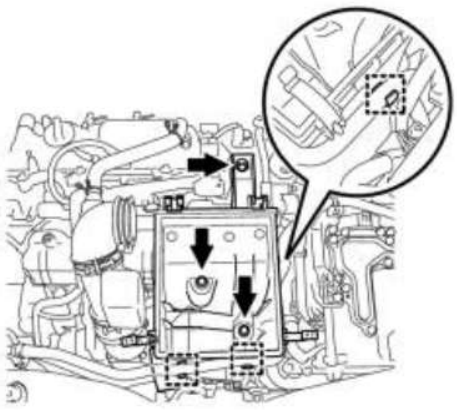
(b) Connect the ventilation hose.

3. INSTALL AIR CLEANER CASE

(a) Install the air cleaner case with the 3 bolts.

Torque: **7.0 N·m (71 kgf·cm, 62in·lbf)**

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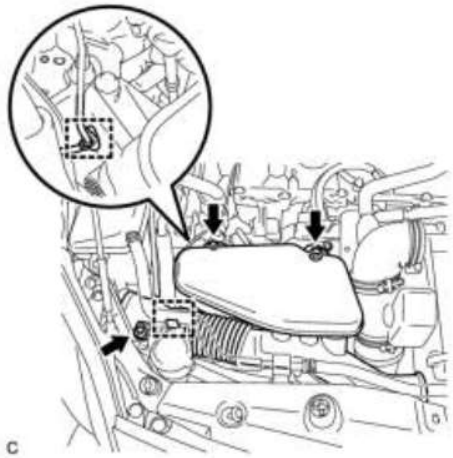


C

(b) Install the hose to the 3 hose clamps.

(c) Install the air cleaner filter element.

4. INSTALL INLET AIR CLEANER ASSEMBLY



C

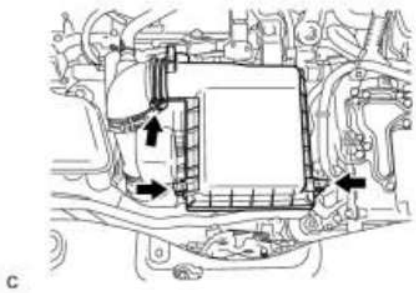
(a) Install the inlet air cleaner assembly with the 3 bolts.

Torque: **7.0 N·m (71 kgf·cm, 62in·lbf)**

(b) Connect the wire harness clamp to the inlet air cleaner assembly.

(c) Install the hose to the hose clamp.

5. INSTALL AIR CLEANER CAP SUB-ASSEMBLY

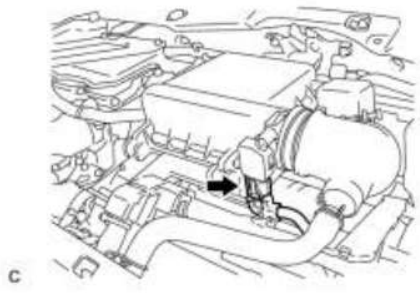


C

(a) Install the air cleaner cap sub-assembly with the 2 clamps.

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(b) Tighten the hose clamp.



(c) Connect the mass air flow meter connector.

6. ADD ENGINE COOLANT (for Engine) INFO

7. INSPECT FOR COOLANT LEAK (for Engine) INFO

8. INSTALL NO. 2 CYLINDER HEAD COVER INFO

9. INSTALL NO. 1 ENGINE UNDER COVER

10. PERFORM INITIALIZATION

NOTICE:

Be sure to perform this procedure after reassembling the throttle body assembly, removing and reinstalling any throttle body component or replacing the ECM.

(a) Disconnect the cable from the negative (-) battery terminal. Wait at least 60 seconds and reconnect the cable.

(b) Connect the Techstream to the DLC3 and clear the DTCs INFO.

(c) Set the vehicle to the inspection mode INFO.

(d) Start the engine without operating the accelerator pedal and check that the MIL is not illuminated and that the idle speed is within the specified range when the air conditioning is switched off after the engine is warmed up.

Standard:

Condition	Engine Idle Speed
A/C switched off	950 to 1050 rpm

NOTICE:

- If the accelerator pedal is operated, perform the above steps again.
- Be sure to perform this step with all accessories off.
- Make sure that park (P) is selected.

(e) Perform a road test and confirm that there are no abnormalities.

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